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RESEARCH DEPARTMENT *BULLETIN No. 10*

TENTH ANNUAL REPORT

OF

THE RESEARCH DEPARTMENT

OF THE

COFFEE BOARD

1956—1957

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COFFEE BOARD RESEARCH DEPARTMENT

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COFFEE BOARD

RESEARCH DEPARTMENT

THE TENTH ANNUAL REPORT

OF THE

RESEARCH DEPARTMENT OF THE COFFEE BOARD

1956—1957

INTRODUCTORY

PART I

ADMINISTRATION

The report covers the period from 1—8—1956 to 31—7—1957.

2. I was in charge of the Research Department throughout the year under report except from 1st August to 26th August, 1956, when I was on a study tour out of India in British East Africa. During this period, Dr. N. G. Chokkanna, Chemist, was in additional charge of the duties of the Director. The following officers continued to hold charge of the respective posts during the year.

Dr. N. G. Chokkanna	...	Chemist
Sri R. L. Narasimhaswamy	...	Botanist
Sri K. V. George	...	Mycologist
Sri B. S. Kuppuswami	..	Agronomist
Sri L. Soans	...	Secretary to Director of Research
Sri P. K. Mathew	...	Asst. Chemist
Sri S. Vishveshwara	...	Asst. Botanist
Sri W. Raghavendra Rao	...	Sr. Liaison Officer
Sri T. V. Pattabhiraman	...	do
Sri G. I. D'Souza	...	do
Sri B. K. Chandrappa	...	do
Sri S. J. Mathias	...	Jr. Liaison Officer
Sri K. T. Bhagat	...	do
Sri H. S. Puttuswamy	...	do
Sri R. Vijaendraswamy	...	do
Sri K. C. Ananth	...	do
Sri L. V. Vaidyanathan	...	do
Sri H. T. Ranga Setty	...	do
Sri H. Hanumantha Rao	...	do
Sri C. Ramakrishnan Nambiar	...	Superintendent

3. Sri B. S. Kuppuswami, Asst. Fruit Specialist, Madras Agricultural Department, was appointed as Agronomist in the Research Department of the Coffee Board. He joined duty on the afternoon of 12th January, 1957.

4. Dr. S. A. Raja Rao, Entomologist, resigned his post and was relieved of his duties with effect from 2 - 1 - 1957 forenoon. The post remained vacant till the period under report.

5. Sri K. B. Ponnappa, Secretary to Director of Research, was relieved on the afternoon of 8th September 1956, on the expiry of his term of appointment. Sri H. S. Krishnamurthy who was promoted and transferred as Secretary joined duty on 18 - 2 - '57 but was relieved in turn on 12 - 6 - '57 afternoon consequent on his transfer to Kozhikode. Sri Lazar Soans joined duty as Secretary on the forenoon of 17th June, 1957

6. Sri R. Vijaendraswamy, Junior Liaison Officer, who was in additional charge of the duties of the Superintendent, Coffee Research sub Station, Chethalli, was relieved of his charge on the forenoon of 1—12—'56 by Sri C. Ramakrishnan Nambiar. The latter who was under training in a private estate was placed in independent charge of the sub Station, Chethalli, from the date of his taking charge.

EXTENSION SERVICE

7. I was in charge of the direction and supervision of the Liaison service and held direct supervisory charge of the Liaison Division of Shevaroys.

8. Sri T. V. Pattabhiraman, Senior Liaison Officer, with headquarters at Coimbatore, continued to be in direct charge of the coffee areas on the Nilgiris, Anamallais, Nelliampathies, Pulneys and other coffee areas of the former Travancore-Cochin State. Consequent on the posting of a separate Junior Liaison Officer for the Pulneys area from 9 - 4—'57, he was relieved of the direct charge of this division. He held supervisory charge of the Wynaad division and the Pulneys division from 9 - 4—'57.

9. The two posts of Senior Liaison Officers lying vacant were filled up towards the end of the year by promoting two of the Junior Liaison Officers. Sri G. I. D'Souza and Sri B. K. Chandrappa assumed charge as Senior Liaison Officers on 3 - 5 - '57 and were placed in supervisory charge of North Mysore zone comprising of Chikmagalur and Mudigere coffee areas and South Mysore zone comprising of Sakalaspur, North and South Coorg respectively.

10. A temporary post of Senior Liaison Officer sanctioned under the Coffee Development Plan was filled by promoting Sri W. Raghavendra Rao, Jr. Liaison Officer, who joined duty on 13—5—'57. His headquarters was fixed at the Coffee Research Station, Balehonnur, with a view to assist the Director in the increased activities due to the implementation of the development plan.

11. Sri K. C. Ananth, Junior Liaison Officer, on completion of his training was posted to be in independent charge of the Pulneys division and joined duty on 9 - 4—'57. Sri L. V. Vaidyanathan, Research Assistant in Chemistry, was promoted as Junior Liaison Officer with effect from 20—12—'56. He was stationed at headquarters till 8th June, 1957, when he

was transferred to Shevaroys division in the place of Sri B. K. Chandrappa promoted as Senior Liaison Officer, Sakalaspur (S. Mysore). Sri H. T. Ranga Setty, Plant Protection Assistant, Chethalli, was promoted to officiate as Junior Liaison Officer at Sakalaspur and Somwarpet from 10—2—'57 to 18—3—'57 and 22—3—'57 to 18—5—'57 in the leave vacancies of Sri W. Raghavendra Rao and Sri K. T. Bhagath respectively. On relief at Somwarpet, he was posted as Jr. Liaison Officer, Sakalaspur, in the place of Sri W. Raghavendra Rao promoted as Senior Liaison Officer (Development). Consequent on the promotion of Sri G. I. D'Souza as Senior Liaison Officer, Chikmagalur (N. Mysore), Sri H. Hanumantha Rao, Research Assistant in Agronomy, was promoted as Junior Liaison Officer as a temporary measure.

12. The Officers and Staff on duty on 31 -7 -'57 and the sanctioned strength are as below :

Category	Sanctioned Strength	No. working on 31—7—1957
Class I ...	1	1
Class II ...		
Heads of Sections ...	5	4
Asst. Research Officers ...	3	2
Senior Liaison Officers ...	4	4
Junior Liaison Officers ...	8	8
Farm and Administration ...	3	2
Class III		
Technical ...	81	57
Ministerial ...	34	27
Class IV Attenders, Drivers etc. ...	38	35
Total	177	140

Consequent on the setting up of special projects and the expansion of Liaison and advisory services, a review of the staff requirements of the Department under all categories of service has been undertaken. Proposals are under consideration for a proper manning of the department vis-a-vis the work load.

The details of various posts and categories are given in Appendix 1.

13. During the year the following posts were filled either after advertisement or by transfer from other departments of the Board

Research Assistants ...	2
Liaison Assistants ...	6
Fieldmen ...	26
Senior Clerk ...	1
Clerks and typists ...	10
Drivers ...	2
Peons ...	4

One Liaison Assistant who underwent training for a period of three months resigned his position in July 1957. Of the 26 Fieldmen, 18 were absorbed after training as regular fieldmen and posted to the various Liaison Zones, 7 more were trained and appointed regularly and one was still undergoing training.

LEAVE

14. The following Officers were on leave during the year for periods noted against each :

1.	Dr. N. G. Chokkanna, Chemist ...	15 days
2.	Sri R. L. Narasimhaswamy, Botanist ...	20 days
3.	Sri K. V. George, Mycologist ...	26 days
4.	Sri G. I. D'Souza, Jr. Liaison Officer ...	27 days
5.	Sri K. T. Bhagat, „ ...	57 days
6.	Sri W. Raghavendra Rao, „ ...	35 days
7.	Sri K. C. Ananth, „ ...	15 days

TOURS

15. I was on tour for 179 days in the year to attend the meetings of the Board and its committees, and to visit areas in Coorg, Mysore, Shevaroys, Wynaad, Nilgiris and Pulneys. The visits to the liaison divisions were mainly for advisory work in problem areas, inspection of the layout and working of the demonstration and exploratory trial plots and in connection with the working of the schemes under the Development Plan. I visited 125 big and an equal number of small estates. The sub Station at Chethalli was visited seven times covering a halt of 15 days during the year for inspection of the work and conduct of research.

I was on deputation out of India in British East Africa till 24th August, 1956.

In April 1956, the Departments of Agriculture in Kenya Colony, Tanganyika Territory and Uganda Protectorate, the Research Officers of Coffee Stations, Central Research and Technical Institutions, the Coffee Board and other agencies were addressed to help in drawing up an itinerary so that as wide a cross section of the industry could be seen and to highlight the very essential things that ought to be seen during the short visit to British East Africa. The Indian High Commission in British East Africa was also contacted to help in arranging the programme and to establish contacts. The itinerary lasted from 22nd June to the I0th of August, I956, and comprised of visits to (I) Research Stations and Research Organisations (2) Plantations and African peasant holdings (3) Coffee Co-operative unions and, (4) the Coffee Boards in these three countries.

Apart from distances covered by air, sea and rail between our home-land and the British East African territories, over 4000 miles of land was traversed by road in the short space of 52 days over hills and dales involving often exhausting dusty journeys of a hundred or more miles a day.

More than 500 people covering a wide range of the industry from research to commercial cultivation, from processing to marketing, and from planning to extension were contacted.

In each of the countries visited, my team and I were given every facility to see as many aspects of the industry as time permitted, to visit and revisit institutions if so desired. Everywhere the desire to exchange information was expressed and valuable contacts were made by which liaison could be sustained and continued.

I am deeply indebted to Mr. A. R. Melville, Mr. F. R. Sanders and Mr. J. Archibald, Chief Research Officers of the Departments of Agriculture, Kenya, Tanganyika and Uganda for the great trouble taken to enable our party to see as wide a cross section of the industry as possible. To the various officers of the Coffee Services in these three countries, I render my thanks for showing us so much of their work and a free exchange of ideas. I am deeply beholden to Mr. McClean and Mr. Devonshire of the Kenya Coffee Board, to the Chairman and Officers of the Tanganyika Coffee Growers' Association, to Mr. King, Director of Agriculture and Mr. Willcock, Chairman and Secretary of the Coffee Industry Board, Uganda, for their great courtesy and consideration.

I would like to express my deep sense of gratitude to the Indian High Commission and all members of the Commission in British East Africa, in particular to Shri Prem Kishan, I.C.S., Shri D. R. Sathe, I.F.S., and Shri B. S. Rao.

The cordiality of the contacts thus established, the consideration and courtesy extended by both the public and private sectors and the constant and cheerful companionship of the three planter members of the team Sriyuts K. H. Srinivasan, A. M. Basave Gowda and A. C. Shive Gowda more than compensated for the rigours of the journey and made the travel instructive, interesting and enjoyable.

The following advances made in British East African coffee were of particular interest for their possible adaptation or at any rate for the reorientation of existing practices in India towards greater production.

(1) The Coffee Industry in British East Africa lays great stress and places a premium on quality at all stages of production, processing and curing. It supports quality by inducement of price bonus.

(2) Co-operative organizations form one of the most attractive phases of the coffee industry in British East Africa. They form an important part of the industry and have contributed to its prosperity, solidarity and soundness. They are in most cases entirely voluntary organizations born out of the will of the producer.

(3) Prize competitions are held as incentive to foster a healthy competitive spirit among peasant farmers and the estate planters alike in the proper maintenance of their land, the eputed high quality of the product and to increase production. Similar competitions suited to our country may perhaps be held as an incentive in the Development Plan.

(4) Farmers' and Employees' short-term Refresher courses are held at the Research Stations in Tanganyika and Kenya, in field techniques. Such courses can well be imitated and should be of great help in the increased production programmes.

16. Dr. N. G. Chokkanna, Chemist, was on tour for 130 days in the coffee areas in Mysore, Coorg, Pulneys and Nilgiris, in connection with advisory work in problem areas on

soil management and nutritional requirements, exploratory work on the field manurial trials, visits to sub Station, Chethalli, and for organising and participation in the several important exhibitions held in the South. He was on deputation out of India on a survey tour of the Andaman Islands from 6—11—'56 to 26—1—'57 in connection with exploring the possibility of coffee cultivation there.

17 Sri R. L. Narasimhaswamy, Botanist, was on tour for 40 days in the coffee areas in Mysore, Coorg, Nilgiris and Shevaroys, inspecting seed blocks of station selections and collection of promising material for future work.

18. Sri K. V. George, Mycologist, toured for 56 days to visit problem areas in Mudigere, Sakalaspur, Shevaroys, Coorg and Chikmagalur zones and to lay out exploratory trials on pest and disease control.

19. Sri B. S. Kuppuswami, Agronomist, was on tour for 15 days to the Coffee Research sub Station, Chethalli, to acquaint himself with the research work done there and to layout field trials on irrigation, mulching etc.

20. The Asst. Research Officers, the Research Assistants and field staff in the several technological divisions were deputed to experimental and problem blocks in the different zones for execution of programme.

CONSTRUCTION OF BUILDINGS

21. The Government of Mysore having intimated their willingness for the State Public Works Department to take over the constructional works of the Research Station at Balehonnur on concessional terms applicable to non-profit making Government and Government aided institutions, an Asst. Engineer with the requisite subordinate staff was posted for the purpose. During the year under report four Senior Staff quarters were nearing completion and plans were got ready for the construction of the Administrative Offices, Staff quarters, Extension to Laboratory and further works in connection with labour amenities and requirements.

22. At the Coffee Research sub Station, Chethalli, the programme of construction as at Balehonnur, was entrusted to the Public Works Department, formerly of Coorg and now of Mysore State. By the end of the year, four Class IV Staff Quarters and two for the Research Assistants started in 1956 were completed. Plans for the construction of a drying yard, extension to the laboratory, Staff quarters and stores were under preparation. The Department is indebted to the two Governments for their help and consideration. No new constructional works were undertaken at this station during the year as the terms of taking over the works was under negotiation with the new State Government.

The rapid expansion of the Department and the manning of the several technical sections at the 2 stations, and setting up of special projects has resulted in an acute shortage of housing and working space. An urgent necessity has, therefore, arisen to take up an early solution of this shortage on top priority basis. Plans have been prepared in consultation with the Public Works Department, Mysore, and are under consideration. In this, I have been greatly helped and encouraged by the sympathy and consideration I have received from the Research Committee and the Chairman of the Board.

LIBRARY

23. Four new periodicals were added to the library thus bringing the total number of journals subscribed to 56 ; 18 journals continued to be received on exchange basis. The total number of journals received at the Station is 74 as against 70 in the previous year.

24. One hundred and fiftynine books were added to the library bringing the total number of books for reference to 980. Of these, 11 were received as gifts from individuals and institutions.

25. Two hundred and twentyseven volumes of loose numbers of old journals were got bound.

26. With a view to equip the liaison officers with standard books of reference on soil management, fertilizers, plant protection etc., 33 books were purchased and supplied.

27. The Officers and Staff of the Research Department made full use of the facilities available in the library and over 650 books were issued to the staff for reference.

MEETINGS

28. I attended four meetings of the Board, two of the Executive Committee and 3 meetings of the Research Committee at Bangalore. An informal meeting of some members of the Research Committee was held at the Coffee Research Station, Balehonnur, early in January 1957. One meeting of the Officers of the Technical and Extension Wings of the Department was held at the Coffee Research Station, Balehonnur, to discuss and review the programme of research, extension and administrative matters and related subjects. Informal meetings with Heads of Sections and field staff were held once a month at Balehonnur and three times at the sub Station, Chethalli, during the year.

29. I attended meetings of the Mysore Planters' Association and Indian Planters' Association, Chikmagalur, an informal meeting of the Coorg Planters' Association, Mercara, and the Planters' Associations at Yercaud and Coonoor. I addressed them on technical aspects of soil management, plant protection, and shade regulation and held post-meeting discussions with groups of planters.

30. I was nominated to represent the Coffee Board in the Pest Control Products Sectional Committee of the Indian Standards Institution. I attended two meetings of the Committee, one at New Delhi and the other at Srinagar.

EXHIBITIONS AND CONFERENCES

31. The Scientific Conference of the U. P. A. S. I., Coonoor, held in August 1956, was attended by the Chemist. The Department also participated in the Exhibition organised during that period.

32 The Research Department participated in the All India Congress Exhibition at Madras, the exhibition in connection with the Centenary celebrations of the University of Madras at Madras, and the Dasara Exhibition at Mysore.

CORRESPONDENCE

33. The number of letters dealt with during the year and in the last year were as follows :

	Balehonnur		Chethalli	
	1955—56	1956—57	1955—56	1956—57
Inward	15,073	15,515	3,246	3,420
Outward	17,468	21,439	4,552	5,690

Correspondence handled at the Research Stations show an increase over last year. The number of advisory letters is on the increase and it is hoped that with the formation of Senior Liaison Circles towards the close of the year, a major part of the advisory correspondence will be dealt with by them.

AUDIT OF ACCOUNTS

34. The Audit of accounts for the year 1955—'56 of the Coffee Research Station, Balehonnur, and the Coffee Research sub Station, Chethalli, was conducted during November and December 1956. The Accounts Officer of the Board conducted physical verification of accounts in September 1956 at Balehonnur.

BUDGET

35. The Budget provisions for the financial year 1956—'57 anticipated a programme of expenditure of Rs. 2,28,000 under Capital Works and Rs. 5,93,600 under Recurring Expenditure inclusive of estate maintenance. An actual expenditure of Rs. 1,31,438 under Capital charges and Rs. 5,08,563 under Recurring charges was incurred during the same period. The considerable savings under " Capital works" were due to a slowing down on the programme of construction of buildings, both laboratory and staff quarters, for want of availability of building materials and suitable contractors. The savings under Recurring Expenditure were mainly the result of not filling sanctioned posts and observance of strict economy in the various branches of the department.

36. The budget for the year under the Development Scheme provides for an expenditure of Rs. 17,000 under Capital works and Rs. 99,000 under recurring expenditure. As the scheme was implemented only towards the end of the year, an expenditure of Rs. 13,509 and Rs. 31,511 under Capital and Recurring charges respectively was incurred leading to considerable economy during the year

37. The budget provisions for the year 1957—58 under both Research and Development Schemes are as follows :

	Capital charges Rs.	Recurring Expenditure Rs.
Research and Extension	2,28,600	6,55.700
Development Scheme	8,000	2,45,200

The expansion of technical sections, provision for building, demonstrations and exploratory activities of the liaison section and the appointment of necessary staff concerned with the Development Scheme have all accounted for increased expenditure proposed by the department.

38. The revenue receipts anticipated and actually realised for the year 1956—'57 and the estimated receipts for 1957—58 are given below :

	1956—57		1957—58
	Anticipated	Actual	Estimated
	Rs.	Rs.	Rs.
Research and Extension	1,83,300	2,30,044	1,82,200
Development Scheme	30,000	19,960	75,000

The increased receipts under Research and Extension are due to a higher coffee crop at both the stations and increased sales of pedigree seed material to the planters.

VISITS

39. The Coffee Research Station, Balehonnur, received over 400 planters and others interested in the planting industry. It was encouraging to note that the trend noticed in the past years of groups of small planters visiting the station either with the Liaison Officers of their division or of their own accord continued in an increasing tempo. A special feature was the visit to the Station of 2 groups of small planters numbering over 50 in all. Students of the Agricultural College, Hebbal, visited the station during the year as a part of their annual training in plantation crops.

40. The Station was privileged to receive the following distinguished visitors.

1. Mr. Gilbert R. Muhr, Technical Co-operation Mission, Bangalore.
2. Mr. Robert Muller, Ruhr stickstoff, Bochum, Germany.
3. Mr. F. Ruicker, Perrot Overhead Irrigation, Germany.

41. Over 300 planters and others interested in Coffee Industry visited the Coffee Research sub Station during the year under report. As in the case of Coffee Research Station, Balehonnur, it was interesting to note that there was frequent inflow of batches of small planters to see, learn and discuss the developments in the scientific management of coffee. These visits enabled the extension staff stationed at the sub Station to secure closer contact with the planting community. The Station had the privilege of receiving the following visitors.

1. Sri K. Radhakrishnan, Principal, I. A. S. Training School, Delhi.
2. General K. M. Cariappa, Retd. Commander-in-chief of India.
3. M/s. John Boonlu and Pradit of Royal Irrigation Department, Thailand.
4. Horticulturist and Agricultural Adviser to Government of Assam.
5. Sri H. S. Rudrappa, Minister for Agriculture, Mysore.
6. The Plantation Crop Specialist, Kerala State.
7. Chief Secretary to Government of Mysore, Bangalore.
8. Members of the Chinese Agricultural Science Study Mission.
9. Forest Officers of the Government of Assam.

The Department is indebted to the Hon'ble Ministers and the Officers of the Mysore Government for their frequent visits to the Station and the continued interest evinced by them in so doing.

TRAINING IN COFFEE CULTURE

42. Under the scheme of training in coffee culture described in the Annual Reports of the previous years, a nominee of the Glen-burn Estates Ltd., and Sri K. O Oommen, a nominee of the Tea Estates India Private Ltd., Nilgiris, were trained during the year. Shri M. M. Nanjappa, son of a planter was also given training in the methods of coffee cultivation.

43. In order that the extension staff appointed under the Development Scheme may be fully conversant with the several aspects of coffee cultivation and liaison work, 7 assistants and 6 fieldmen at the Coffee Research Station, Balehonnur, and 8 fieldmen at the Coffee Research sub Station, Chettalli, were given intensive training for periods ranging from 3 months to 9 months before they were posted to the different Liaison divisions.

44. Sri K. K. Purkayastha of Cinchona Directorate of the West Bengal Government deputed to study the methods of coffee cultivation, was taken to estates in the Chikmagalur zone and round the Coffee Research Station, Balehonnur.

ANNUAL CELEBRATIONS

45. The Independence Day and the Republic Day were celebrated at both the Stations. The mazdoors were granted holidays with wages on these days and entertained to sports and refreshments.

EXCHANGE OF SEED MATERIAL

46 The Station is indebted to the following persons and institutions for sending valuable coffee and other seed and seedling materials.

1. The Head, Plant Introduction Section, Horticultural Crops Research Branch, U. S. D. A., Beltsville, Maryland, U.S.A.
2. Director, Instituto Agronomico do Estado de Sao Paulo, Campinas, Sao Paulo, Brazil.
3. Officer-in charge, Coffee Research Unit, Kawanda Agricultural Research Station, Kampala, Uganda.
4. Chief Coffee Research Officer, Agricultural Department, Government of the Union of Burma, Rangoon.
5. Director, Experimental Station C. P. V., Proefstation Der Centrale Proefstations Vereniging, Bogor, Indonesia.
6. Director of Agriculture, Department of Agriculture, Kenya.
7. Sri Kesavagopal Naidu, Dy. Conservator of Forests, Andamans.

PUBLICATIONS

47. Popular notes on technological problems of immediate interest to planters, warning notes on pest and disease incidence, and articles of a scientific nature were prepared and published in the journals noted against each.

Scientific articles

1. Fundamentals of Coffee Culture – Problems for Research by Dr. B. T. Narayanan, Indian Coffee, January 1957.

2. Incidence and control of hairy caterpillar on Arabica Coffee on the Bababudangiris, Chikmagalur by G. I. D'Souza. Indian Coffee, March 1957.
3. Leaf symptoms of biuret toxicity in Coffee by L. V. Vaidyanathan, N. G. Chokkanna and B. T. Narayanan Indian Journal of Horticulture, September 1956.
4. On the occurrence of two species of Bostrichidae (Coleoptera) on coffee by S. A Raja Rao and C. K. Vasudevan. Currrent Science, June 1957.

Popular articles

1. Trends in cultivation of arabica on the Bababudangiris by G. I. D'Souza. Indian Coffee, December 1956.
2. Nursery practices in Wynaad by S. J. Mathias Indian Coffee, April 1957.
3. Contoured Coffee in Cottanad - an example in erosion control by S. J Mathias. Indian Coffee, May 1957.
4. Improvement of Coffee in Shevaroys. Indian Coffee, June 1957.
5. Travelogue I - Indian Study Team in British East Africa by Dr. B. T. Narayanan. Indian Coffee, July 1957.
6. Fighting the Greenbug of coffee. Indian Farming, June 1957.
7. What to do about the Coffee Leaf Disease ? by K. V. George. Indian Farming, July 1957.

Reports

Report on a visit to the Coffee producing countries in British East Africa by Dr. B T. Narayanan. Planters' Chronicle, May 1, June 1, and June 15, '57.

In addition, two warning notes, one answer to questions, abstracts of seven articles of popular interest, and brief abstracts from reports, bulletins and scientific journals dealing with coffee and related products were published in the Indian Coffee.

48. During the year, the ninth Annual Report of the Research Department of the Coffee Board for the year 1955-56 and 19 leaflets on various aspects of cultivation of coffee were printed.

49. A brief note on the work done by the Research Department in 1956-57 was prepared and sent to the Ministry of Commerce and Consumer Industry, Government of India, and a brief technical report on research work of the Department to the Ministry of Food and Agriculture, Government of India, and Secretary, Indian Council of Agricultural Research, New Delhi.

A comprehensive note on coffee to be included in " Agriculture in India - The Prospect " was prepared and sent to the Farmers' Forum, New Delhi.

FIELD STATIONS

50. Sri R. Vijaendraswamy, Jr. Liaision Officer, who was in additional charge of the post of Superintendent, Coffee Research sub Station, Chethalli, was relieved of his charge on the forenoon of 9 - 12—'56 by Sri C. Ramakrishnan Nambiar. The latter after the completion of his training at the main station and in a private estate, was placed in full charge of the administrative and financial control of the sub Station.

51. Sri H. Hanumantha Rao, Asst. in Agronomy who was in additional charge of the post of Farm Assistant at the main station from the beginning of the year, was relieved of his charge by Sri T. H. Thimme Gowda on 2—1—1957 on his transfer from the sub Station, Chethalli.

SEASON AND CROP

BALEHONNUR

52. A total rainfall of 105.10 inches was received during the year (August to July) as against 115.06 inches for the corresponding period in the previous year and against 111.65 inches being the average for the past ten-year period. Thus the rainfall during the year fell short of he last year's total by 9.96 inches and the decennial average by 6.55 inches. The rains were fairly well distributed on 156 rainy days.

53. The South West monsoon of 1956 which commenced during the third week of June, strengthened and the month of June 1956, recorded a rainfall of 28.30 inches against the decennial average of 16.09 inches and is the highest ever recorded so far in the history of the Station for that month. The monsoon continued to be active during the months of July and August and a total precipitation of 65.91 inches was recorded The monsoon weakened by the first week of September and after a short spell of dry weather, the N. E. monsoon set in. The latter strengthened towards the close of September and was active throughout October. The monsoon again weakened by the middle of November. The precipitation, however, was distributed uniformly throughout the monsoon months.

54. After the cessation of the N. E. monsoon a fairly long dry period of 143 days was experienced. This was in striking contrast to the short dry period of 89 days experienced during the previous year. No summer showers were received during February and March.

55. The blossom showers of 1957 were received on 15th and 16th April. These were followed by backing showers on 18th and from 20th to 22nd. This resulted in the opening of 60 per cent of the blossoms of robusta on the 8th and 9th days and about 85 per cent of the blossoms of arabica on 9th and 10th days after the receipt of showers. The rest opened later. The continued light showers, the cloudy weather in the mornings and the presence of dew and mist were expected to have adversely affected the blossom, but the favourable turn in the weather at the end of the month resulted in the recovery of a majority of bushes.

56. A crop of 14.25 tons of arabica, 3.75 tons of robusta and 0.25 tons of tree coffee aggregating to 18.25 tons was harvested during 1956-57 season as against an estimate of 17, 7 and half a ton of arabica, robusta and tree coffee respectively. The crop prospects for the year 1957-58 are estimated at 13.5 tons of arabica, 6.5 tons of robusta and 0.5 ton of tree coffee. The estimate in respect of arabica had to be revised to 16.0 tons due to favourable weather conditions existing latterly.

CHETHALLI

57. A total rainfall of 74.12 inches was received during the year which was in excess of the decennial average by 4.36 inches. An even distribution of rains throughout the major part of the year and a dry period during December to March helped considerably the coffee bushes and the crop prospects looked bright for the coming year.

58. An incipient shower of 15 cents received in the middle of March proved ineffective in moving the blossoms. A good precipitation of 1 03 inches received on the last day of the month, however, forced out the blossoms evenly on both the arabica and robusta. This coupled with adequate backing showers received in the first week of April assure the prospect of more than an average crop.

59. A crop of 42.5 tons was picked during the year 1956-57 against an estimate of 23.5 tons. The crop estimate for the year 1957-58 is placed at 46.0 tons. The trend of even crops and increasing average yields continued to be maintained during the year.

DISEASES AND PESTS

BALEHONNUR

Leaf Disease

60. The incidence of leaf disease during the year 1956 was negligible due perhaps to the low carry over from the previous season. The light and intermittent showers received during August-September 1956, caused considerable spread of the disease in October but the incidence was lower in comparison to the previous year. Again, the prolonged rains till the middle of November made conditions ideal for the multiplication and extension of the disease and leaf fall started towards the end of November and continued till February 1957. It was feared that the ideal conditions existing in the previous months for the spread of the disease might result in an early and serious out break of the disease in the year 1957. Fortunately, the long dry period extending over 143 days from the middle of November to mid-April put an efficient check to the multiplication of the disease. Though the pre-monsoon conditions with their intermittent and light drizzles and the comparatively light showers received in the early part of the S W. monsoon were ideal for the spread of the disease, the continuous and heavy downpour received in July mitigated the favourable conditions and arrested any extensive spreading of the disease. Towards the end of July, the rains slowed down and along with this, the disease activity and spread have also started.

61. It may be seen from the above that in spite of the very favourable weather conditions experienced during the pre-monsoon and early monsoon months, the disease incidence was very low. This was due to the very prolonged, adverse summer conditions and the timely spraying operations undertaken. At the time of writing this report, conditions are again becoming ideal for a build up of the disease and it is to be expected that it may become fairly serious in October-November 1957, unless protective operations are taken on hand at the right time.

Black Rot

62. Incidence of black-rot was negligible during the 1956 S. W. monsoon rains. The blocks which are endemic to black-rot showed a mild attack of the trouble. But immediate attention to handling of diseased material, timely shade regulation and spraying with one per cent Bordeaux mixture checked further spread. The disease has not been noticed to be severe during the year 1957.

NURSERY DISEASES

63. Incidence of damping off and collar rot of seedlings, both in the primary germination beds as well as after transplanting to baskets and beds, was comparatively less during the year 1957. However, a new malady affecting the seedlings was observed during the period August to October 1956. Affected seedlings showed malformations on the stem, mostly at the first or second node from the ground level, and as a result, a number of affected seedlings snapped off at the weakened infected area. The loss was as high as 20 per cent during the year.

64. A light incidence of Cercospora was observed in the nursery during August-October 1956. With the cessation of the rains by the middle of November, and the favourable weather conditions prevailing, the disease was on the increase followed by considerable defoliation of affected leaves. The onset of the dry conditions from January 1957 kept the disease under check but the favourable, light intermittent showers received from April onwards caused active spread of the disease. Repeated fungicidal applications have, however, kept the disease under check and the affected seedlings have commenced putting forth new growth from end of July onwards.

COFFEE STEM BORER

65. The percentage of infestation with stem borer during the year was 0.46 as against 0.59 in the previous year computed on the total population on the estate. Against an yearly average of over 5,000 plants removed in the quinquennium 1949-54, the plants removed during 1955-56 and 1956-57 were only 707 and 585 respectively. The regular programme of rigid tracing of borer and removal of affected plants and the continuance of the timely plant protection measures in the two flight seasons by the application of BHC to the stems have prevented further increases in pest population.

GREEN BUG

66. The incidence of green bug was in general low during the year. Contrary to last year's observations, it was noticed that the increased activity of the entomogenous fungii in the post-monsoon months due to extended rains till late November 1956, and the rapid multiplication and spread of the insect parasites in the summer months have effectively kept the pest in check.

SHOT-HOLE BORER

67. Shot-hole borer infestation was very low during the year. Observations again confirmed last year's findings viz., that the incidence increased from August to January and thereafter decreased up to July.

MINOR PESTS

68. Sporadic appearance of other pests like the leaf-roller, leaf-eating loopers, weevils and a leaf-miner were noticed on young plants in the nursery. They were, however, kept in check by timely spraying with Organo-phosphorus pesticides.

CHETHALLI

69. The leaf disease situation at the Coffee Research sub Station, continued to be mild during the year under report. The usual two sprays in the year followed by a tip spray in

November to older plants and young strugglers helped in arresting the spread of the disease. There was also an appreciable carry-over of healthy leaves throughout the season. The estate was particularly free from black rot and other minor diseases

70. Regular tracing of borer affected plants and timely protection with application of insecticides continued to pay good dividends. There was a remarkable reduction of borer infested plants to 547 from 1001 in the previous year. The incidence of greenbug was negligible. There were no noticeable attacks of other pests of coffee.

GENERAL

71. Both the Stations continued to be members of the U. P. A. S. I. and the Regional Planters' Associations. The sub Station was a member of the Coorg Orange Growers' Co-operative Society also.

72. The labour strength at Balehonnur which was 164 at the end of last year rose to 169 at the beginning of the year and closed with 140 against a sanctioned strength of 170. The average labour turn-out was 62 6 per cent against the previous year's average of 81.01 per cent. At Chethalli, the year started with 110 on the check-roll and closed at 107 against the sanctioned strength of 130. The average turn-out was 86.60 per cent against 89.89 per cent of the previous year. Employer-employee relationship continued to be cordial and happy both at Balehonnur and Chethalli.

73 The wages and allowances of the mazdoors at both the Stations were enhanced from 1st April, 1957, as a result of the settlement arrived at between the Plantation Labour and the Coffee, Tea and Rubber Planters of Mysore (including Coorg before the Labour Commissioner, Mysore. The benefits of Provident Fund were also extended to them during the year.

HEALTH AND MEDICAL FACILITIES

74. The health of the staff and labour was good throughout the year. Medical facilities were provided by part-time services of the local medical officers of the Mysore and Coorg (pre-integration) states. Local anti-malaria squads attended to D. D. T. spraying of all estate quarters at both the stations.

HARVEST

75. The yield of uncured Coffee during the year is :

	Yield of coffee in bushels (uncured)				
	BALEHONNUR			CHETHALLI	
	Arabica	Robusta	Tree Coffee	Arabica	Robusta
A—Parchmennt ...	840—0	161—5	—	2670—0	46 8
B—Cherry ...	441—8	180—5	44	1308—0	106—0
C—Gleanings and Bits ...	131—0	33—0	—	246—24	10—0
D—Others including seed coffee ...	89—4	25—14	—	—	—
Total ...	1501—12	399—24	44	4224—24	162—8
Yield of clean coffee in tons ...	14.25	3.75	0.25	—	—
Total tons ..	18.25			42.50	

AREA-REPLANTING AND NEW CLEARING

76. The area under coffee in the two stations are :

	Planted Area (In acres)		Bearing Area (In acres)	
	Arabica	Robusta	Arabica	Robusta
Balehonnur ...	100.48	27.61	73.03	25.08
Chethalli ...	110.76	10.04	85.77	4.96

77. The estimated yield of clean coffee for 1957-58 is 23.00 tons at Balehonnur and 46.0 tons at Chethalli.

78. In pursuance of the policy of replanting old, un-economic and pest-ridden coffee at the Coffee Research Station, Balehonnur, 2.25 acres of old coffee were uprooted and 1.00 acre was planted to varieties and species of coffee imported from other countries as well as those obtained from estates within the country and to progenies of out-standing plants of station selections. An area of 6.75 acres remaining unplanted out of the eight acres of jungle cleared last year, were utilised for laying out progeny trials of arabica and robusta, for planting with world collections, station crosses and self-bred progeny and for the Brazilian method of planting

79. At Chethalli there were no new clearings or replanting of coffee during the year.

SEED AND SEEDLING SUPPLY

80. The Zonal seed plots on private estates were continued to meet the increasing demand for seeds of station selections. Nine planters in Mysore Zone, six in Coorg, and one each in Shevaroys and the Nilgiris co-operated in the establishment of these seed plots. Seed coffee was prepared under the supervision of the department. 8079 lb of seeds of arabica selections collected from these blocks were distributed during the year. In the same period 5318 lb. of arabica, 341 lb. of Robusta and 26 lb. of seeds of excelsa were prepared and distributed against 3609 lb., 923 lb. and 27 lb. of arabica, robusta and excelsa respectively in the previous year. The total seed supply of station selections during the year and in the preceding year are shown in the following table as also the number of growers to whom they were distributed.

	Seeds distributed in lb. during		No. of planters supplied in	
	1956—57	1955—56	1956—57	1955—56
Arabica selections	13,397	10,669		
Robusta selections	341	1,353	2,034	1,693
Tree Coffee	26	27		

81. To satisfy repeated representations from peasant planters, seedling regional nurseries revived during the last year were continued and as many as 25 were in operation during the year in private estates in the different Liaison Zones. A total of 1,18,116 seedlings of arabica and 44,000 of robusta were distributed during the year as against 1,29,000 and 44,000 numbers raised respectively in the previous year.

PADDY

82. Paddy was grown on 1.67 acres at Balehonnur and 6.0 acres at Chethalli. Efforts were made to follow up as closely as possible the Japanese method of cultivation. The following quantities of grain and straw were obtained during the year and in the preceding year:

	Area (In acres)	Yield of grain (in lb.)		Yield of straw (in lb.)	
		1955—56	1956 - 57	1955—56	1956—57
Balehonnur	1.67	4100	2808	5100	6300
Chethalli	6.00	15890	14181	9000	9867

The yield at Balehonnur was low as at setting time continuous rains were experienced while at Chethalli the yield of grain was slightly lower than that of the previous year.

ORANGE

83. The orange crop at Chethalii was the highest ever recorded in the history of the station. A sum of Rs. 11,577 was realised against Rs. 7,701 obtained in the previous year. The prospects for the coming year are satisfactory.

OTHERS

84. A small quantity of 4 lb. of pepper was picked at Balehonnur. About 200 cutttings of pepper were planted during the year as the existing vines in the station are becoming aged. A sum of Rs. 60 was realised by auction sale of soapnuts.

GENERAL AMENITIES

85. The two stations continued to have their own arrangements for water supply. Power supply from the State Electricity Department, Mysore, was secured during the year for electric power and light at the Coffee Research Station, Belehonnur. Arrangements were under way to commission the generator released at the main station for purposes of power and light at the sub Station, Chethalli.

86. A canteen was being run at Belehonnur for the benefit of the mazdoors. New buildings to house the canteen and the dispensary were constructed during the year. The creche for the children at Chethalli continued to be maintained. Milk for babies and midday meal for non-working children were provided. A radio was working at each of the stations. Screening of films of technological and rural interest was arranged for the benefit of the staff and the mazdoors and three were shown during the year. Services of the cart were made available for conveying the school going children at the Coffee Research sub Station, Chethalli, to the Higher Elementary School at the 10th mile - a distance of one mile from the station.

ACKNOWLEDGMENTS

87. It is my privilege and pleasant duty to express my deep sense of gratitude and that of all members of the Research Department to the many planters who have so generously co-operated in the layout of various field trials and demonstration plots and given unstinted help in so

generous a measure. I would in particular extend our grateful thanks to Messrs. S. N. Ramanna, R. Radcliffe, F. G. Foster, C. Primrose, M. C. Mathew, M. K. Jinachandran, K. M. Verghese Mapillai, U. K. Lakshman Gowda, W. Woodbridge, K. A. Aiyappa, G. M. Manjanathaya, J. L. Short and Col. W. A Rahm.

88. To Messrs. Kothari, Mehta and Sons Ltd., Consolidated Coffee Estates (1943) Ltd., Claim Ltd., Anaparai Estates Ltd., Rajendra Coffee Estates Ltd., and Badra Coffee Estates Ltd., the Department and I are indebted for facilities afforded for experimental work.

89. To many scientists in India and abroad who exchanged publications and material I am deeply grateful. It is with gratification and pleasure I record the very happy associations with many technological institutions and the Departments of Agriculture in Mysore and Madras and their technical, technological and extension divisions in particular.

90. It is my privilege and pleasant duty to express a deep sense of gratitude of myself and the members of the Entomology Division of the Research Department to the Director and members of the Staff of the Commonwealth Institute of Entomology, London, who were generous in identifying the insect specimens sent from the Research Department from time to time.

91. To the various proprietary and other firms who co-operated in the conduct of field trials, I am beholden.

92. I and my colleagues record with gratitude the kindness and consideration we have received from the members of the various committees of the Coffee Board. To the members of the Research Committee, I am particularly indebted. Their support and consideration have been as ever unfailing and a source of encouragement to me in my work.

93. I am deeply grateful to Sri K. Srinivasan, Chairman, Coffee Board, for his kindness, consideration and the unfailing interest and the valuable guidance he has extended to me and the department.

94. To the planting community who have willingly placed at the disposal of the department their knowledge and enthused us in the solution of their many problems and for their traditional generosity, hospitality and consideration to myself and every individual member of the staff alike, I extend my deep sense of appreciation and gratitude.

95. To the various grades of technical, executive and ministerial services at the two Research Stations and the Liaison Divisions, I cannot be sufficiently grateful. They have borne cheerfully the brunt of the burden by their unstinted hard work and ever willing co-operation.

96. A brief review of the work done in the different Liaison and Scientific Divisions together with the Sectional Reports is given in the following pages.

B. T. NARAYANAN,

Director of Research.

APPENDIX 1

Statement Showing the Sanctioned Strength of Staff and Actual Number Working as on 31st July 1957

Sl. No.	Category/ Scale of Pay	Research & Extension		Development	
		Sanctioned strength	Actual working	Sanctioned strength	Actual working
1.	**Class I**				
	Director of Research	1	1	—	—
2.	**Class II(a) Rs. 275-800**				
	Chemist	1	1	—	—
	Botanist	1	1	—	—
	Agronomist	1	1	—	—
	Mycologist	1	1	—	—
	Entomologist	1	—	—	—
	Senior Liaison Officers	3	3	1	1
	(b) **Rs. 250-500**				
	Asst. Chemist	1	1		
	Asst. Botanist	1	1		
	Asst. Mycologist	1	—	(Post held in abeyance)	
	Secretary to Director of Research	1	1		
	Superintendent, Coffee Research Station and Coffee Research sub Station	2	1	(The post at C.R.S. held in abeyance)	
	Junior Liaison Officers	8	8	—	—
3.	**Class III (a) Rs. 160-10-330**				
	Research Assistants	8	5	4	2
	Farm Assistant	1	1	—	—
	Liaison Assistants	—	—	16	5
	Statistical Assistant	—	—	1	—
	(b) **Rs. 100-5-125-6-185-EB-8-225**				
	Mechanic	1	1	—	—
	(c) Fieldmen Rs. 60-130	34	33	14	7+1 (under training)
	(d) Fitter Rs. 60-5/2-75-3-105	1	1	—	—
	(e) Compounder do	1	—	—	—
	(f Head Clerks Rs. 100-250	4	3	—	—
	(g) Senior Clerks Rs. 80-220	6	4	—	—
	(h) Camp Clerk Rs 80-220	1	1	—	—
	(i) Stenographer Rs. 80-220	1	1	—	—
	(j) Junior Clerks Rs. 60-130	9	8	2	2
	(k) Typists Rs. 60-130	2	2	9	7
4.	**Class IV**				
	(a) Drivers Rs. 40-2-60	6	4	1	1
	(b) Lab. Attenders Rs. 30-½-35	7	6	—	—
	(c) Mechaninal Attenders Rs. 30-½-35	2	2	—	—
	(d) T. B. Attenders do	3	3	—	—
	(e) Peons do	18	18	1	1
	Total ...	128	113	49	27

PART I I
EXTENSION SERVICE

During the year two more Senior Liaison Circles were formed at Chikmagalur and Sakalaspur respectively in addition to the existing one at Coimbatore, with a view to co-ordinating the activities of the Junior Liaison Officers and make effective use of the services of increased personnel employed under the Extension and Development wings of the Research Department. Sri G. I. D'Souza and Sri B. K Chandrappa were posted to be in charge of the above circles respectively. Sri K. C. Ananth, Sri H. T. Ranga Setty and Sri L. V. Vaidyanathan, Junior Liaison Officers, were posted to Pulneys, Sakalaspur and Shevaroys divisions respectively and Sri. H. Hanumantha Rao, Research Assistant, was promoted as temporary Junior Liaison Officer, Chikmagalur. There were no changes in the personnel of the other divisions.

2. Consequent on the implementation of the Development Programme, Sri. W. Raghavendra Rao was posted as Senior Liaison Officer with headquarters at Balehonnur in June 1957. Besides being in immediate charge of the coffee areas in and around the Research Station, he will relieve the Director of routine advisory and administrative matters to enable the latter to make new contacts and sustain old ones and to devote greater attention in the implementation of the developmental activities of the department.

3 I toured the Liaison Divisions of Mysore, Coorg, Shevaroys, Nilgiris and Nelliampathies contacting 65 big and 130 small planters. Advantage was taken of these visits to contact groups of planters and discuss zonal problems with them. Particular emphasis was laid during these discussions on systematic cultivation and a re-orientation of techniques suited to the locality. The co-operation of the planters was also enlisted to adopt these improved techniques under the guidance of the local Liaison Officer. Opportunity was also taken to impress upon them the necessity for re-planting and rejuvenating their plantations and the possibility of so doing to pedigree material with the assistance of the Department.

4. These contacts with planters had very happy reciprocal results. In many cases, especially in Pulneys and parts of less advanced areas of Wynaad and others, it was possible to establish large-scale reorientated cultural practices with the active co-operation of the planter himself. It was also possible to invoke the active interest of many of these in the demonstration of improved methods of cultivation that was being shown on selected plots in their zone, resulting in increased numbers of composite cultural demonstration plots and the adoption by an appreciable number of several of the recommended measures.

5. The year saw planters, especially the small holders either in groups or individually come to both the Research Stations.

6. The encouraging response to the presence of the Liaison Officers in the several plantation districts noticed during last year continued to be generously extended as reflected in the rising tempo of advisory correspondence demanded from this office, the Liaison divisions and the associated technical sections. Over 15,000 advisory notes were issued from the main and sub Station, being an increase of 50 per cent over that of last year. The Liaison divisions hemselves issued over 4900 advisory letters.

The number of composite demonstrations on small planters' estates started in the earlier year on half acre blocks were extended to cover 2 acres each. A further number of 52 blocks were laid out bringing the toal number to 107. These blocks are intended to put into practice cultural, plant protection, manurial, shade and plant improvement practices which the Department advocates for the particular zone.

At the same time large scale re-orientation blocks to put into practice special amendments, modifications or extension of cultural practices were undertaken in all the coffee zones. 31 plots covering over 150 acres were thus laid down against 5 plots of 30 acres in the earlier year.

Field manurial trials laid out in earlier years were extended to cover larger area of field fertility differences. Each block of 4 different treatment variations were allocated in a separate small planter's estate, the replications being laid out in different climatic, ecological and soil fertility levels. It has been programmed to lay down six and not less than 4 of such plots in each of the liaison zones. 14 plots had been laid out at the time of writing this report. (vide Appendix II).

The Liaison Section was also responsible for assistance in assessing the suitability of applications for grants-in-aid loans under the Development Plan. 557 applications were received and spot inspections were undertaken to assess their suitability (vide Appendix IV).

7. A brief review of the work done in the several Liaison Divisions is presented below.

COIMBATORE LIAISON CIRCLE

8. Sri T. V. Pattabhiraman was in charge of the Coimbatore Liaison Circle throughout the year under report. This circle comprised the Nilgiris (Plateau), Nelliampathies, Anamallais, Travancore and Pulneys. Consequent on the creation of a new and seperate Liaison Zone for Pulneys from April 1957, this was placed under the direct charge of a Junior Liaison Officer. He continued to hold supervisory charge of Malabar, Nilgiris, Wynaad and the Shevaroys Liasion Divisions during the year and the Pulneys Division from April of this year.

9. He was on tour for 179 days and visited 242 estates contacting 1011 coffee growers. He addressed 5 gatherings of planters and disposed off 69 applications for loans under the Coffee Development Plan. 3282 letters were received as against 783 in the previous year and necessary advisory work pertaining to problems on re-orientation of cultural practices, rehabilitation and plant protection rendered.

10. Pulneys and the Nilgiris (Plateau) as stated in the earlier reports presented problems peculiar to predominantly North East monsoon areas. The low but almost continuous rainfall with a very short dry period favouring multiplication of leaf disease, lack of scientific principles of crop and land management, the mixed economy of growing coffee and bananas together and the growing of coffee in marginal areas (especially on the Nilgiris) have all necessitated the drawing up of a revised calendar of operations.

11. Large-scale demonstrations with the revised calendar of operations started in private estates three years ago have yielded sizable dividends with 300 per cent increase in

crops being registered. This has resulted in over 50 estates of peasant farmers in the neighbourhood taking to these improved practices.

12. Gradual replacement of the existing disease susceptible, uneconomical and marginal coffee is being pursued. In addition to the six varietal trials that are already in progress, 169 lb. of seeds of the three important Station Selections have been distributed to 35 planters.

13. A field manurial trial at Maruvahalla in Kotagiri was continued. One varietal trial at Glenburn estate and one plant protection trial in the same estate were also continued during the year. In addition to the existing single demonstration plot, three re-orientation plots were newly laid out.

14. Anamallais, Taliar, Nelliampathies and Biligiris, though predominantly subject to South West monsoon rains, again present a special problem in that these receive an appreciable quantity of the rains during the North East monsoon also. Moreover, these areas are principally of large holdings and of advanced management. Nevertheless, some re-orientation of the empirical practices now in operation seemed desirable to get a maximum return out of undoubtedly good husbandry. Five re-orientation plots, one each in Nelliampathies, Taliar and Biligiris and two in Anamallais were newly started towards the end of the year. One plant protection trial for the control of greenbug of coffee by the use of systemics was also started.

15. Coffee, mostly robusta, is grown all over Travancore from almost sea level upto 2000 feet elevation. These are generally in small holdings coffee being grown more or less as garden plants in the kitchen gardens. The general condition is not satisfactory and it is possible that both unsuitability of elevation and unsatiafactory working may be the contributory factors. One re-orientation block has been laid out. A large number of applications were registered for the supply of seeds of Station Selections of arabica.

CHIKMAGALUR LIAISON CIRCLE

16. Sri G. I. D'Souza assumed charge of the newly formed North Mysore Circle on 3—5—1957 with Chikmagalur as headquarters and jurisdiction over Chikmagalur and Mudigere Liaison divisions. Sri L. Pereira was appointed as peon from 29—7—1957 and arrangements were in progress to post the necessary complement of staff.

17. The Senior Liaison Officer was on tour for 38 days and visited an equal number of estates contacting as many as 114 growers. He addressed six gatherings of planters and gave advice to 170 growers both in person and by post on problems of plant protection, rehabilitation and cultural practices.

18. During the period under report, the incidence of leaf disease was negligible White stem borer and green bug were found occurring in localised patches but did not assume pest proportions. Red borer has been found to be on the increase in and around Doddengudda and shot-hole borer on Robusta in Banakal and Koppa zones. Cercospora was found causing economic losses in the nursery and new clearings in the Mudigere division. Suitable plant protection measures were advocated for the control of the several pests and diseases.

SAKALASPUR LIAISON CIRCLE

19. Sri B. K. Chandrappa assumed charge of the newly formed South Mysore Circle on 6th. July, 1957, with headquarters at Sakalaspur and jurisdiction over Sakalaspur, North Coorg and South Coorg Liaison divisons. Sri M. Narahari, Research Assistant (Development), who was specially deputed to work on the nursery and field diseases of coffee on a project scale reported for duty on 25—7—1957. Arrangements were in progress to post the necessary complement of staff.

20. The monsoon of 1956 in the Sakalaspur area was satisfactory and the rains were generally in excess of the previous years. During 1957 the monsoon rains were disappointing as distribution was not equitable. Crop shedding to varying extent was noticed and the estimates do not appear cheerful for the year 1957-'58. The production of necessary wood for the next year's crop was also not promising. In Coorg the general weather conditions were satisfactory and at the same time favourable for the spread of leaf disease. Instances of berry shedding were also reported but the general outlook for the next crop is fair.

21. The incidence of leaf disease and the damage due to borers affecting both arabica and robusta was at the minimum. Reports of damage by eelworms were received from a few estates, and in view of the possible spread to neighbouring plantations, trials of an exploratory nature were laid out to devise suitable control measures. Cercospora in a severe form has been reported from Sakalaspur Zone and Ponnampet Nad of South Coorg and investigations have been taken up for detailed study.

22. He was on tour for 27 days and visited 75 estates contacting 120 planters, both big and small. He gave necessary advice on problems relating to coffee to 24 growers, both by post and in person.

SENIOR LIAISON OFFICER (DEVELOPMENT), BALEHONNUR

23. Sri W. Raghavendra Rao, appointed as Senior Liaison Officer in connection with the implementation of the Development Programme of the Reasearch Department, reported for duty on 8th. June, 1957. Arrangements were made to post the necessary staff to this section.

24. He was on tour for 13 days to survey the incidence of red borer in Mudigere Zone, to investigate the new malady affecting nursery and young clearings in the Sakalaspur division and to enquire into the causes responsible for the heavy defoliation and formation of malformed leaves in estates in Coorg. He visited the Coffee Research sub Station, Chethalli, and Chikmagalur to examine the fitness of fieldmen trainees for regular absorption in the Department.

25. He visited five demonstration and varietal cum exploratory trial plots in Sakalaspur and Coorg Zones to assess the progress made and contacted as many as eight groups of planters. Advice regarding improved methods of coffee cultivation, modern plant protection measures and use of improved seed material was given.

CHIKMAGALUR LIAISON DIVISION

26. Sri G. I. D'Souza, Junior Liaison Officer, continued to be in charge of the division till 2nd. May, 1957, when he was promoted as Senior Liaison Officer. He continued to

hold charge of the post till 5th. June, 1957, when he was relieved by Sri H. Hanumantha Rao of the additional charge. Sri G. I. D'Souza was on earned leave for 17 days from 20 – 12—1956 to 5—1—1957 during which period Sri L. V. Vaidyanathan, Offg. Junior Liaison Officer at Balehonnur, was in charge of the current duties of Junior Liaison Officer, Chikmagalur.

27. Sri K. R. Ahobala Rao was posted as Liaison Assistant and joined duty on 9th. April, 1957. The field staff was strengthened by the posting of two more fieldmen and the post of junior clerk was also filled up. The subordinate staff were on earned leave for short periods during the year.

28. The monsoon during the year was normal except on the Upper Giris where higher precipitations were registered. The North East monsoon rains extended till the last week of November. The long dry weather conditions from December to March were broken by blossom showers which were received in small amounts from March to May. This resulted in running blossoms. The crop prospects are not bright for the year.

29. The incidence of white stem borer and green bug were negligible. Damage to coffee and shade trees by hairy caterpillars in a few estates were reported and timely action was instituted to control the same. Isolated infestations by red borer and Cercorspora were kept in check by suitable chemical, prophylactic and phytosanitary measures.

30. A total quantity of 1721 lb. of seed coffee of the major Station Selections was distributed to 174 growers during the year as against 921.5 lb. of seed in the previous year. The demand for Station Selections, especially S. 795, is on the increase.

31. Four demonstration plots (bringing the total to 12), four differential manurial blocks and two re-orientation blocks were newly started during the year. These have now attained full-fledged status as centres for propaganda in methods of improving crop yields specially at the lower acreage levels. Two field manurial trials at Togarihankal and Bynecool and six varietal trials in six estates were in progress. The white stem borer control trial, the trial to control the green bug of coffee, modified to include new pesticides, and two trials to study the effects of higher concentrations of Bordeaux mixture and 2,4-D on leaf fall and fruit shed of coffee were initiated during the year.

32. He was on tour for 194 days, visited 270 estates, contacted 281 planters and addressed 8 meetings of planters, both big and small. Advisory letters totalling 178 were issued on problems of rehabilitation, manurial and cultivation practices and plant protection measures. He also visited 57 estates for assessing the value of these in connection with the sanction of grant-in-aid loans. The results of the frequent contacts and the opening up of more demonstration centres have made the planters aware of the necessity of timely manuring and spraying of coffee. An estimated quantity of 1200 tons of fertilizers during the first quarter of 1957 has been sold against the previous year's total of 1694 tons. During the year supply of 38 double action D. S. P., 14 single cylinder D. S. P. and three pulpers was arranged.

33. The co-operative pulping unit at Mallandur continued to work satisfactorily during the year. A quantity of 1923 bushels of coffee was pulped as against 732 bushels

last year. The net earnings during the year amounted to Rs. 602/- against Rs. 158/- in the previous year and the society was able to repay one fifth of the loan granted by the Research Department. The co-operative unit demonstrated successfully the usefulness of the venture in increasing the out put of parchment coffee. Towards the close of the year, efforts were under way to organise another growers' co-operative pulping and spraying society in the zone.

MUDIGERE LIAISON DIVISION

34. Sri. H. S. Puttuswamy continued to be in charge of the division.

35. The complement of office and field staff consisting of one junior clerk and three fieldmen were posted during the year.

36. The unfavourable weather conditions prevailing at the beginning of the year caused severe leaf shed and berry drop in Kalasa, Banakal and Javali areas The harvests were also delayed consequently. The blossom showers during 1957 were in general favourable in most parts of the zone. Inadequate backing showers in parts of Koppa and Balehonnur affected the set and development of robusta crop. However, the general prospects for both arabica and robusta crops are good, with expectations of 15 to 20 per cent more crop than last year. The early onset of the South West monsoon and the continuously heavy rains experienced between May and July interfered with pre-monsoon spraying and manuring.

37. The weather conditions during August-September 1956, were very favourable for the rapid spread of leaf disease. This caused a heavy incidence of leaf shedding in parts of Niduvale and Javali areas but in other areas the disease was not severe. The weather conditions during May - June, 1957, also appear to be very favourable for the disease. The symptoms of the disease are noticeable in most of the estates in the zone and it is feared that the incidence may be more severe than that experienced in the past two years.

38. The incidence of white stem borer, green bug and other minor pests like cut worms and hairy caterpillars was negligible during the year due to increased use of chemicals and timely phytosanitary measures. The shot-hole borer on robusta was seen to be very severe in parts of Banakal and Koppa areas and the red borer in Doddengudda, Kelagane, Baskal and Dunduga estates. Adherence to a pre-determined schedule of operations and timely plant protection measures have been advocated to the growers and intensive studies on these pests have been planned in co-operation with the research staff.

39. Among the nursery diseases, collar rot and Cercospora assumed serious proportions in many of the estates in the zone. Prompt and timely recommendations by the department helped to keep in check the diseases. A research assistant has been specially posted towards the close of the year to investigate and suggest control measures for the above maladies.

40. A total quantity of 3143 lb. of improved seed material was distributed to 499 growers against 1257 lb. and 227 growers respectively in the previous year. During the year, 12,000 basket seedlings of S. 795 raised in three regional nurseries in the zone were also distributed to many small planters at nominal cost.

41. A detailed study of the performance of the Station Selections in selected estates and general observations in the zone showed that these are gaining in popularity among growers, big and small alike. The Selection, S. 333, which comes up well at Urvinkhan and Murkull is not quite happy in Mudigere, Gonibed and Aldur areas and from the point of vigour and growth is behind S.795 and S. 288. They are also susceptible to nursery diseases, perhaps on account of their vigorous growth in the nursery.

42. Four demonstration plots (in addition to the existing eight), eight re-orientation blocks and four differential manurial plots were newly laid out during the year. These have brought in their wake an effective response from the neighbouring growers, who have begun to adopt the schedule of operations now being given to these plots. The modified robusta manurial trial in Banakal estate was continued but the one at Uggehally estate had to be discontinued. The six exploratory cum varietal trials started previously were continued. One trial to compare the efficacy of different pesticides against white stem borer of coffee and another to compare the efficacy of Flit 406 with Bordeaux mixture in controlling leaf disease were newly laid down during the year.

43. He was on tour for 225 days, visited 480 estates, contacted 670 planters and participated in 31 group meetings and discussions of planters. He also attended two meetings convened by the Development Officer of the Coffee Board in connection with the implementation of the Development Plan. A total of 1564 advisory correspondence on matters pertaining to coffee cultivation, plant protection measures, supply of seeds etc., was disposed off. Eighty loan applications and 70 valuation reports were disposed off after visits to the concerned estates and necessary enquiries. A batch of planters from the zone were taken on a conducted tour of the estates in South Coorg and Somwarpet zones and to the Coffee Research sub Station, Chethalli. The frequent contacts with the planters and the regular follow-up visits have engendered the necessary enthusiasm among planters to adopt improved cultivation and manurial practices, timely plant protection measures, and soil conservation practices.

44. Arrangements were made to collect 300 bushels of S. 288 parchment coffee from Kumergode estate for export to London market for a study of the market reaction to Station Selections.

45. A small growers' co-operative credit and produce society was organised during the year with 35 members and a share capital of Rs. 1600/-. The Society has so far distributed Rs. 15,000/- as loans to 13 growers.

SAKALASPUR LIAISON DIVISION

46. Sri W. Raghavendra Rao continued to be in charge of the division till 30—5—1957 when he was transferred to Balehonnur as Senior Liaison Officer. Sri H. T. Ranga Setty who relieved the former continued to be Junior Liaison Officer till the end of the period under report. Sri W. Raghavendra Rao was on earned leave for 35 days from 10th. February to 18th. March, 1957, when Sri H. T. Ranga Setty acted in the leave vacancy.

47. Sri L. Raju was posted as Liaison Assistant and joined duty on 7th. April, 1957. Sri. Aithappa Naik was appointed as temporary junior clerk from 15th. March, 1957. The field staff was strengthened by the posting of two more fieldmen.

48. The rainfall during the monsoon of the year 1956 was normal. Blossom showers for the 1957—58 crop were received in time and in adequate quantities except in a few estates round Cheekanahalli and Ballupet. In these estates paddying of the flower buds in arabica and poor set in robusta were noticed. The crop estimates are generally 10 to 15 per cent below that of the last year.

49. The incidence of white stem borer was very low. The use of B. H C. 50% and rigorous borer tracing in the past few years have brought the pest population to such a low level that the application of pesticide in April has been discontinued in a few estates without any harmful results. The other pests of coffee viz., red borer and green bug were of minor importance. Exploratory trials with soil ameliorants and nemacides to control the eel-worm have been laid in Ossoor and Belagode estates.

50. The leaf disease situation was not serious. On the other hand, heavy casualties from nurseries and new clearings due to Cercospora, collar rot and a new malady affecting stems were reported. Timely remedial measures have been recommended to keep in check the diseases. Special staff has been appointed to investigate into the causes and suggest suitable remedial measures.

51. A total quantity of 1623 lb. seeds of Station Selections was distributed to 206 growers during the year. The study of performance of the Station Selections in the several sub-zones was undertaken. Selections S. 795 and S. 288 are popular in major parts of the zone and S. 947 is reported to be popular in and around Ballupet and Sakalaspur while S. 952 has been found to be adaptable to the heavy rainfall areas of Archully.

52. Two demonstration plots were added during the year to bring the total to 10. Work on two re-orientation blocks and five differential manurial trial plots is proposed to be taken up during the post-monsoon of 1957. The eight field manurial trials with arabica and robusta in Karadibetta, Sulgode, Cheekanahally, Ossoor and Harley estates were continued. Five exploratory trials to define a cheap and effective insecticide against the stem borer and eel-worm were newly started in two estates. The five varietal trials of Station Selections were continued.

53. He was on tour for 247 days, visited 467 estates, contacted over 600 growers both big and small, and participated in 10 meetings and group discussions of planters. Advisory correspondence totalling 120 were issued on routine matters of coffee cultivation, soil and manurial practices and plant protection measures. He also visited 95 estates for assessing the value of these in connection with the sanction of grant-in-aid loans.

NORTH COORG LIAISON DIVISION, SOMWARPET

54. Sri K.T. Bhagat continued to be in charge of the Division during the period under report except for a period of 57 days from 22—3—1957 to 18—5—1957 when he was away on earned leave. Sri H.T.Ranga Setty was posted in his leave vacancy.

55. Additions to field staff were made by posting two more fieldmen. Sri H. V. Sastry was appointed as temporary junior clerk with effect from 30—10—1956 The subordinate staff were on leave for short periods during the year.

56. The weather conditions during the monsoon of 1956 were abnormal. Heavy rains, above the average, were experienced in almost all the sub-zones and were uniformly distributed throughout the year except during January and February. The blossom showers were normal and adequate and the crop prospects are bright.

57. Leaf disease incidence was at a minimum. The long drought period coupled with heavy showers during the monsoon prevented the possibility of the spread of the disease. The usual spray programme and in addition the application of tip-spray effectively kept the disease under check. Stray occurrences of black rot in heavy rainfall areas were controlled by timely application of Bordeaux sprays

58. The incidence of white stem borer and green bug was negligible. The shot-hole borer on robusta was reported from a number of estates in Murnad and Bhagamandla areas. Since the use of insecticides against this pest is still not practicable, vigorous propaganda has been launched during the year to persuade planters to take up control measures like pruning and burning of affected twigs, adequate manuring and thinning of shade. The red borer, usually a minor pest of arabica, also assumed serious proportions in Sanivarasanthe, Belur, Chethalli and Somwarpet areas and was found attacking new clearings. Detailed control measures like cutting and burning of the affected twigs and application of cotton wad dipped in chloroform or spirit were advocated.

59. A total quantity of 2346 lb. of seeds of Station Selections was distributed to 475 growers as against 1081 lb. of seeds and 214 growers in the previous year. Three regional nurseries were also established at Anekere, Icola, and Hardoor estates and as many as 25,000 seedlings of S. 795 were supplied to small growers at nominal cost.

60. Six demonstration plots were laid out during the year bringing the total in the area to 12. These, laid out in representative areas of the zone, continued to show improvement in respect of yield and growth. The visible signs of improvement have attracted the attention of growers round about and enthused them to follow the schedule of operations now being given to these plots. The four exploratory cum varietal trials, the stem borer control experiment in Madegode estate, the eel-worm control experiment at Coovercolly and the field manurial trial at Malamby in Sanivarsanthe area were continued. Two more trials for the control of eel-worm were laid out during the year.

61. He was on tour for 210 days, visited 315 estates, contacted over 400 growers and addressed 23 gatherings of planters. Advisory correspondence totalling 1361 on matters pertaining to coffee cultivation, improved cultural techniques, pest control and effective shade formation were attended to. Seventy four estates were visited to assess their value regarding the sanction of grant-in-aid loans. Two problem areas were visited and concerted measures were taken with the help of the research staff to redress the deficiency in the estates.

SOUTH COORG LIAISON DIVISION, CHETHALLI

62. Sri R. Vijaendraswami continued to be in charge of this division during the year under report. He was relieved of the additional charge of the duties of the Superintendent, Coffee Research sub Station, Chethalli, with effect from 1st. December, 1956.

63. The full complement of the staff consisting of one temporary junior clerk, two fieldmen and one peon was appointed between October, 1956 to January, 1957.

64. The seasonal conditions during the year were normal and the crop harvested in 1957 was much above expectations. The blossom showers for the 1958 crop were received in April 1957. The South West monsoon was below normal and intermittent showers with bright sunshine resulted in premature shedding and reduced fruit set. However, the crop prospects are satisfactory and a tonnage equal to the one last picked may be expected.

65. The incidence due to pests and diseases was low during the year. Timely spraying with Bordeaux mixture against leaf disease and swabbing the stems with 50 per cent B. H. C. during the flight periods of the stem borer pest have kept in check their spread. Infestation of arabica with root mealy bugs was reported from Ponnampet and Srimangala areas. Protective measures and heavy manuring have effectively controlled the pest and checked their spread

66. A total quantity of 1650 lb of seeds of Station Selections was distributed to 361 growers as against 649 lb. and 127 growers in the previous year. Five regional nurseries were established in representative sub-zones and 11,630 seedlings of S.795 were distributed to 48 growers at cost price. In addition, arrangements were made to induce large planters to raise seedlings of S. 795 and distribute them to the neighbouring small growers. In this way 4,000 seedlings were distributed by Huvinakadu estate.

67. Ten composite demonstration plots and two re-orientation blocks were newly started during the year. The two modified Robusta Field Manurial trials in Yemmegoondi and Huvinakadu were continued. Three trials to study the efficacy of various insecticides against the control of white stem borer and eel-worm were initiated.

68. The Liaison Officer was on tour for 178 days, visited 285 estates, and contacted more than 1235 growers, mostly owning less than 25 acres. As many as 65 demonstrations of the several operations like planting of coffee, manuring, shade regulation and plant protection measures were done in the growers' fields by the staff. The number of advisory work attended to both in person and by post was 750. Out of nintysix applications for sanction of loans referred by the Development Department, 86 were disposed off after visiting the estates concerned ; valuation of properties in respect of 60 were also furnished. 10 applications were rejected and later withdrawn by the applicants.

NILGIRI-MALABAR WYNAAD LIAISON DIVISON, KALPETTA

69. Sri S. J. Mathias continued to be in charge of the division during the entire period under report.

70. Sri K. Haridas Menon was posted as Liaison Assistant and joined duty on 9th. April, 1957. Sri V. R. Gopalan was appointed as temporary junior clerk from 22nd. December, 1956. The field staff was strengthened by the posting of three fieldmen.

71. The seasonal conditions during the year were satisfactory. A record crop of 4,000 tons in Malabar Wynaad and 1400 tons in Nilgiri Wynaad was picked during the year 1956-57. The blossom showers for the crop year 1958 were received early in January in the

Malabar area. But the setting was not satisfactory due to non-receipt of adequate backing showers. On the other hand, in the Nilgiri Wynaad, blossom showers were received in March with even backing showers. An estimate of 4,000 and 1,800 tons respectively in the two areas is expected.

72. In Nilgiri Wynaad the leaf disease situation was comparatively mild. Reports of infestation due to white stem borer were received from a number of estates near Gudalur and Nellakotta. The incidence of shot-hole borer on robusta was noticed in most of the areas in Malabar Wynaad. Timely plant protection measures and adherence to a pre-determined schedule of operations kept them under control effectively.

73. A total quantity of 1439 lb. of seeds of Station Selections was distributed to 141 planters during the year. These may cover approximately an area of 1400 acres against 284 acres planted in the previous year

74. Fourteen demonstration plots, in addition to the existing eight, were started during the year. The four robusta manurial trials, the two modified manurial trials on robusta, the four exploratory cum varietal trials and the trial to find out the efficacy of different pesticides for the control of coffee stem borer on arabica were continued. In addition, a trial to control the growth of grass by deep digging was started newly in Modankunnu Estate, Kalpetta. The composite demonstration block opened in 1955 continued to serve as a visual guide in enlightening scientific methods of cultivation and dissemination of results achieved.

75. He was on tour for 221 days, visited 375 estates, contacted 754 planters and addressed 27 gatherings and association of planters. Advisory correspondence totalling 61 on matters pertaining to coffee cultivation, improved cultural practices, and plant protection measures were attended to. He also visited 71 estates in connection with their valuation for the sanction of grant in aid loans.

SHEVAROYS LIAISON DIVISON, YERCAUD

76. Sri B. K. Chandrappa continued to be in charge of the Division till 26th. June, 1957, when he was transferred to Sakalaspur. Sri L. V. Vaidyanathan who relieved the former on 27th. June, continued to hold charge of the post for the rest of the year.

77. Sri P. P. Simon was appointed as temporary junior clerk with effect from 31—10—56. The field staff was strengthened by the posting of two fieldmen in March, 1957.

78. The seasonal conditions during the year were satisfactory. The North East monsoon rainfall was above the decennial average. The blossom showers were received in February and March Though blossom occurred in waves, due to receipt of timely and adequate backing showers the crop set was satisfactory. It is estimated that a crop of 2200 tons will be picked against last year's production of 990 tons.

79. The incidence of leaf disease during the year was severe due to the favourable conditions prevailing for its spread. The intermittent showers with intervening bright days in the post-monsoon months were very conducive for rapid spread. However, timely and effective spraying with Bordeaux mixture has largely helped in minimising the attack. Other diseases like Cercospora and root-rot were of minor importance.

80. Reports of infestation by green bug were received from a large number of estates. The pest was on the increase due to the favourable summer conditions and the failure of the natural parasites to multiply in sufficient numbers. However, timely control measures by spraying with pesticides effectively kept the pest under control. The white stem borer of coffee was also noticed but not in very serious proportions due to the regular and periodical operations of swabbing the stems with B.H.C. and removal and burning of infested plants. A few minor pests of coffee causing negligible damage were also reported.

81. A quantity of 428 lb. of seeds of Station Selections was distributed to 57 planters during the year. Three regional seedling nurseries were established in three estates and 14,300 seedlings were distributed to planters at cost price.

82. Twelve composite demonstration plots, one re-orientation block and six differential manurial trial plots were started during the year. The exploratory cum varietal trial plot, the field manurial trial, and the borer control experiments were continued. Six new trials to study the optimum time of spraying with Bordeaux mixture and comparison of different fungicides in controlling leaf disease and trials for the control of the incidence of green bug by the use of systemics and stem borer by the use of pesticides were newly laid.

83. He was on tour for 219 days, visited 350 estates, and contacted 400 growers both big and small. Advisory correspondence totalling 300 on matters pertaining to plant protection, manuring, shade regulation etc., were issued. He also visited 15 estates in connection with their valuation for the sanction of grant-in-aid loans.

PULNEYS LIAISON DIVISION, COIMBATORE

84. Sri T. V. Pattabhiraman was in charge of the Division till 8th. April, 1957 when Sri K. C. Ananth, after the completion of his training, was posted in independent charge of this division. The latter was on earned leave for 15 days from 4th. May to 18th. May, 1957.

85. Sri P. K. Ramachandran, was posted as Liaison Assistant and joined duty on 9th April, 1957. Sri R. G. Shribas was posted as temporary junior clerk from 13th May, 1957.

The field staff was strengthened by the posting of two fieldmen during April-May of the year.

86. The area is situated in the North East monsoon zone and demands a re-adjustment in the timing of many of the routine essential cultural, protective and manurial operations practised in the established coffee areas of the S W. monsoon zone. The fact that coffee in Pulneys is grown as a mixed crop, with bananas taking a major share of attention has also to be reckoned with. Rainfall throughout the year added to the problem of effective disease control.

87. The coffee in this zone experienced severe attacks of leaf disease, green bug and stem borer. The last named was very heavy in Bodi and Sirumalai areas. The contacts with groups of planters helped in re-orientation of cultural practices, especially plant protection measures with special reference to timing and an awakened interest in proper and adequate manuring. Gradual replacement of the existing disease susceptible, uneconomical and marginal

coffee was being pursued. The results are encouraging in that the returns from both big and small estates show definite signs of improvement.

88. Five re-orientation plots were newly laid out during the year. Arrangements were made to open 20 demonstration blocks in the coming year. The four exploratory cum varietal trial plots, three demonstration and one re-orientation plots already laid out last year were continued.

89. He was on tour for 42 days, visited 48 estates, contacted 83 planters and addressed two gatherings of planters. Fifty four estates were visited in connection with the sanction of grant-in-aid loans. Advisory correspondence numbering 129 on matters of cultivation of coffee, spray and manurial practices, supply of seed etc., were attended to.

90. During the year, 293 lb. of seeds of Station Selections were distributed to 51 planters. The four exploratory cum varietal trial plots started previously were continued.

B. T. NARAYANAN,
Director of Research,
Coffee Board.

APPENDIX II

Chart showing Progressive number of Demonstration Blocks (Improvement Blocks) / Reorientation Plots / Differential Manurial Blocks / Field Manurial Trial Plots / Varietal Trial Plots and Plant Protection Trial Plots in the different Liaison Zones

Serial No.	Name of Liaison Zone	1955—56						1956—57					
		Demonstration blocks	Reorientation plots	Differential Manurial plots	Field Manurial trial plots	Varietal trial plots	Plant protection trial plots	Demonstration blocks	Reorientation plots	Differential Manurial plots	Field Manurial trial plots	Varietal trial plots	Plant protection trial plots
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Chikmagalur ...	8	Nil	Nil	2	6	Nil	12	2	4	2	6	4
2	Mudigere ...	8	Nil	Nil	4	6	5	12	8	4	4	6	7
3	Sakalaspur ...	8	Nil	Nil	8	5	Nil	10	Nil	Nil	8	5	5
4	North Coorg ...	6	Nil	Nil	1	4	2	12	Nil	Nil	1	4	4
5	South Coorg ...	5	Nil	Nil	2	Nil	Nil	15	2	Nil	2	Nil	3
6	Kalpetta ...	8	Nil	Nil	6	4	1	22	Nil	Nil	6	4	1
7	Yercaud ...	8	4	Nil	1	1	Nil	20	5	6	1	1	6
8	Coimbatore Nilgiris Anamallais Nelliampathies ...	1	Nil	Nil	1	1	1	1	8	Nil	1	1	2
9	Pulneys ...	3	1	Nil	Nil	4	Nil	3	6	Nil	Nil	4	Nil
	Total Number...	55	5	Nil	25	31	9	107	31	14	25	31	32

APPENDIX III

Statement showing the quantity of Seed Coffee of Station Selections distributed and number of planters to whom distributed—Liaison Zone wise

Serial No.	Name of the Liaison Zone	Quantity of seed distributed during 1956—57 season	Number of planters to whom seed was distributed
		(in lb.)	
1	Chikmagalur ...	1,721 lb.	174
2	Mudigere ...	3,143 „	499
3	Sakalaspur ...	1,623 „	206
4	North Coorg ...	2,346 „	475
5	South Coorg ...	1,650 „	361
6	Kalpetta ...	1,439 „	141
7	Yercaud ...	428 „	57
8	Coimbatore ...	169 „	35
9	Pulneys ...	293 „	51
10	Other Areas ...	585 „	35
	TOTAL ...	13,397 lb.	2,034

APPENDIX IV

Statement showing the number of applications for Grants—in—Aid Loans referred to and disposed off by the Liaison Officers

1956—1957

Serial No.	Liaison Division	Number of applications referred to the Liaison Officers
1	Chikmagalur ...	57
2	Mudigere ...	80
3	Sakalaspur ...	95
4	South Coorg ...	96
5	North Coorg ...	74
6	Kalpetta ...	71
7	Coimbatore (Nilgiris) ... (T.C. State) (Pulneys)	69
8	Yercaud ...	15
	TOTAL ...	557

PART III

RESEARCH

AGRONOMY

Trials started earlier on the influence of different cultural practices on yield of coffee, cultivation methods, management operations and manuring of Robusta and pruning were continued. Studies on the retention of berries on Station Selections, and germination of arabica and robusta seeds were continued as in the previous year. Two new trials on mulching of young coffee and a new method of estimation of the crop were put under way during the year.

The experiments on soil cultivation methods - trenching, renovation pitting, light and deep digging and soil management operations with various grades of digging during different seasons are in the third year of study and no significant results have so far been obtained. The indications are that different types of trenching, renovation pitting and light digging are likely to produce better results.

Three experiments on manuring of Robusta coffee with and without pruning are in the fifth year of study and no significant differences in the yields have yet been obtained. The trends so far show that there is little to choose between the two levels of nitrogen but that application of 40 lb. of nitrogen with pruning is likely to be economical in the long run. The results of this year's data are varying, 40 lb. nitrogen giving the highest yield in one, pruning alone in the second and a combination of the above two in the third.

In a study of the effect of topping Robusta plants at two heights started five years back, it was observed that in the first three years better growth of primary branches resulted by topping at the lower height of 3 feet, while in the fourth year, plants topped at a higher level produced better growth. During the two years they have been in bearing, plants topped at a higher level have given higher yields

Two new trials have been started during the year on young arabica coffee to find out the effects on growth and yield by mulching, growing green manure and cover crops.

Observations on the berry-retention in the different arabica selections and Kents during the past two years showed that the maximum percentage of berries carried to ripening is not a varietal character but conditioned by several factors like seasonal conditions, health and vigour of the plant.

In the studies on the germination of seeds, it was seen that there was a gradual decline in viability as the period of storage increased. Preserving the seeds in charcoal and storing them in gunny or cloth bags or in tins contributed to increased germination percentages. An admixture of jungle soil and compost at higher proportions gave better germination Pre-treatment of seeds without their parchment cover, with two strengths of Sulphuric acid inhibited germination while with parchment cover on, treatment with 50 per cent Sulphuric acid for 5 minutes was better than either concentrated acid or treatment for 3 minutes. On the other hand, treatment with various growth promoting substances did not aid germination. It was observed that drying of the seeds in shade contributed to better germination.

An observational trial to study the Brazilian method of planting 4 seedlings in pits, spaced widely apart but, with shade started towards the close of the last year was continued.

Studies on the shade requirements of Arabica coffee started last year at the Coffee Research sub Station, Chethalli were continued. It is intended to find out suitable types and combinations of shade trees and to compare the influence of single type of shade tree against the mixed shade.

BOTANY

Work on coffee breeding with reference to leaf disease resistance and high and uniform yielding qualities were continued. Selfing and hybridisation of selected plants, raising their progenies for performance tests, vegetative propagation of promising bearers, comparative trials of clonal progenies raised from promising materials and collection and establishment of plant material of local and foreign origin as foundation stock were in progress. Cytogenetical studies on inter-specific hybrids of coffee were continued.

Pure line breeding to isolate selections resistant to leaf disease and with high and even bearing qualities was extended by raising seedlings of 2nd and 3rd generation progeny of one Arabica culture, 4th generation progeny of another, and 4th and 5th generation of two other Arabica cultures as well as F_2 and F_3 of Arabica selections crossbred with commercial strains of Coorg, Kents and Maragogype. A high degree of resistance to leaf disease was noticed in the third generation progeny of S. 795.

Selfing of second generation of three Arabica cultures, 3rd and 4th generation of another and F_2 and F_3 of Arabica cultures crossbred with Kents and Coorg variety of Arabica were undertaken to raise further generations for study.

Out of eleven and ten inter-crosses laid out in the field during 1954 and 1955 respectively, only three crosses of the former showed freedom from leaf disease while in the others the range of infection varied from 1.3 to 38 percent. Four crosses of the former showing high incidence of leaf disease were discarded. Sixteen more inter-crosses were planted in the field during 1956 and 25 more raised during 1957 for a study of their resistance to leaf disease, yield and vigour. In the last of the hybrids, a high yielding selection from Lyamungu and a disease resistant collection from Anglo-Egyptian Sudan have been used as parents among others.

In the trials laid out to study the back cross of hybirds (Robusta x Arabica), evolved as well as naturally occurring (Devamachi), with Kents Arabica, it was seen that the seedlings were free from leaf disease though a certain loss in vigour was seen as the seedlings aged. Inter-specific crosses involving arabica, robusta and congensis were effected during the year.

Progeny tests to isolate best performers out of 36 arabica and 17 roubsta cultures were continued. The former continued to show freedom from leaf disease. It is too early to assess their performance as they are in the third and second year of their cropping respectively. Seedling progenies of 20 arabica (BA Series) and 12 robusta cultures (BR Series) were planted in a comparative trial using the latest techniques of layout adopted in other countries.

The cytological work on inter-specific hybrids was intensified. Robusta has 22 somatic chromosomes and Kents arabica has 44 chromosomes. The progeny of the cross between the

two contained 33 chromosomes, and was semi-fertile. They were vigorous and resistant to leaf disease also. Back crossing the progeny with the noble parent, Kent, gave rise to a number of plants having 2n = 44 chromosomes while a few with 33 and 55 were also observed. Though the plants, especially those with 2n = 44, showed high fertility and resistance to leaf disease, they varied widely in their morphological and fruit characters. A high percentage of pea - berries was also observed. Selfed progeny of promising plants and their crosses with Kents, Coorgs and Station Selections have been raised and a few promising lines are under study.

The F_1 of the cross between Robusta and Kents arabica was also back-crossed with Robusta. The resulting progeny contained plants having 2n = 44 chromosomes. Self-bred lines from these are continuing to show a high degree of fertility and resistance to leaf disease but with morphological characters of the Robusta parent.

The studies to root single noded leafy sucker cuttings of both arabica and robusta gave a maximum success of 60 per cent under large scale planting. In the trial to test the efficacy of two new proprietary products, Seradix L. 15 and L. 30 , it was seen that the general method of treating with cow's urine extract gave 78.8 per cent rooting as against 75.6 and 76.7 per cent of the two products respectively. Top-working trials with arabica scions on robusta stocks using the technique of wedge grafting gave encouraging success of over 90 per cent with one year old wood and 86 per cent with tender shoots. This offers an easy method of converting robusta plants and small crops from the latter can be obtained during the period of conversion till such time as the arabica scions start cropping.

The exchange of seed material between several coffee growing areas in the world and this station was continued. The progress of the introductions totalling 114 of Arabica, 4 of Liberica, 6 of Robusta, 2 of Excelsa and one each of Racemosa and Salvatrix continued to be satisfactory. While all the varieties of arabica were showing susceptibility to leaf disease to varying extents, five of them from Ethiopia showed comparatively very light infection.

Experiments laid out to compare the performance of both arabica and robusta trained by the multiple stem system as against the common practice of growing coffee on single stems, showed that practically no differences in yields were noticeable between the trees trained by either system. Though the pruning of the trees trained by the multiple stem method is comparatively easier, the incidence of white stem-borer on arabica and shot-hole borer on robusta appears to be high.

In the trial to study the performance of the Station Selections at the sub-Station, Chethalli, it was seen that S. 795 has been consistently giving high yields for the fifth year in succession.

CHEMISTRY

Experiments on the manurial requirements of coffee, land management with specia reference to soil and moisture conservation, influence of trace elements on growth and health factors and studies on the processing of the crop were continued.

In the permanent manurial trial to study the essential requirements of the three major plant foods, the yields for the seventeenth year were recorded. Application of nitrogen and

phosphorus gave the highest yield and was superior to nitrogen only or nitrogen and potash or untreated control but not to complete fertilizer. The average yield over 17 years also follows almost the same pattern. Grouping the yields of clean coffee into periods of five years and expressing them as percentages of control, the following results were obtained:—

	N.	N.P.	N.K.	N.P.K.	Control
1949—53	136.3	129.0	129.0	126.6	100
1950—54	141.2	129.1	138.0	136.7	100
1951—55	120.1	129.8	122.0	122.7	100
1952—56	112.6	130.0	112.8	120.4	100
1953—57	118.4	146.6	118.3	134.0	100

It is observed that yield increases over control has been steady in the case of treatment with nitrogen and phosphorus while with other treatments, the yields have been fluctuating from year to year, leading to the inference that phosphates help in the better utilisation of nitrogen and that the latter, by itself alone, does not produce yields proportionate to increased fertilizers applied.

These fundamental experiments were extended to trials on the different forms of nitrogen, on the application of varying doses of nitrogen from 40 to 100 lb. with fixed levels of potash and phosphorus, on the application of varying doses of phosphorus and potash with a fixed basic level of nitrogen, and on the application of varying levels and combinations of N, P, and K on specially planted plots since 1952.

Field trials to find out the optimum economic dose of nitrogen and the role of phosphorus and potash in the utilisation of the former, the observational trial son the effect of increasing doses of manure and the effect of fertilizer mixtures containing insecticides were in progress.

Field manurial trials with arabica coffee started in ten estates in different soil and climatic zones on the application of 40 to 100 lb. of nitrogen in split doses, with and without phosphorus and potash brought out the importance of phosphorus in enhancing crop yields and the feasibility of applying nitrogen in two or more split doses. The trials further brought out that up to 80 lb. of nitrogen, application of 30 and 40 lb. of phosphorus and potash respectively may be adequate but at higher levels of nitrogen, increased applications of the latter may become necessary.

Similar trials on robusta in progress in five estates gave indications that application of a complete fertilizer containing the three major plant foods is likely to lead to higher yields. The modified robusta manurial trials with due emphasis on increasing doses of phosphorus and potash relative to that of nitrogen laid in 14 estates were continued.

Experiments on the response to manuring of coffee seedlings in the nursery showed that prepared soil was better than ordinary soil. Application of phosphates in conjunction with liming the soils led to an increase in the number of primaries and leaves carried by the seedlings. Indications were also to be found that application of potash in addition led to better growth of seedlings. Extended trials to determine the maximum economic dose of nitrogen, with and without the application of phosphorus and potash were in progress.

A field trial to study the effect of chelated metals and trace elements on the growth and yield of coffee was newly started during the year.

Studies on soil moisture requirements and the influence of shade on soil conditions confirmed last year's findings viz., that shade trees are likely to compete with the coffee plants for moisture during critical periods of the year, in the initial years of establishment.

The trial to study the effect of Duraset-20W (a flower and fruit setting hormone) on flower and fruit set in both arabica and robusta showed that the hormone was not effective in increasing fruit set. In the exploratory trial to study the influence of moisture on the development of spikes, it was seen that application of water to the soil caused a majority of the mature buds to blossom irrespective of the micro-climatic conditions obtaining around the plant.

Studies on the elimination of fruity flavour of cherry coffee by washing the fruits with warm and cold water, with alkali or acids or with chemicals did not yield any results except that washing with water improved the quality to a little extent.

ENTOMOLOGY

Studies on the seasonal intensity of incidence of the major pests like Stem borer, Green bug and Nematodes on **arabica** coffee and Shot hole borer on **robusta** and their chemical control by the use of chlorinated hydrocarbons and organo-phosphorus compounds, including systemics, were continued. Studies on the biological control of certain pests on coffee with their parasites were also extended.

The relative effectiveness of various insecticides like BHC, its formulations; Folidol E 605 Con., Chlordane, Aldrin and Dieldrin, at various concentrations, and at different numbers of applications, was evaluated against White Stem borer. Of these, BHC 50% W. P. and one of its formulations, Inexit W. P. at 0.03%; and Dieldrin at 0.125 to 0.5% have consistently effected good control of the pest. Further field scale trials with newer products are in progress in different Liaison Zones.

Trials with organo-phosphorus insecticides including systemics were continued against Green bug. Metasystox at 1 to 1.5% con. when used as a systemic poison on young plants, gave 60 to 90% control. However, on old plants the results were not very promising. Newer products like Basudin and Isochlorothion are being tested for their efficacy against the pest.

Experiments on the control of Shot-hole borer of **robusta** using organic pesticides like BHC, Dieldrin and Heptachlor and systemics like Systox, Metasystox and Ekatin have not been conclusive. Further trials, with suitable modifications on the techniques employed, have been newly started and are in progress.

In experiments conducted to test the effects of soil amendments in the control of Nematode, it was found that application of amendments containing Sulphur helped to keep the Nematode population at a low level. Extended trials with soil amendments and other pesticides like VC-13 Nemacide, Crag fungicide and Nemagon have been laid in three estates during the year. Application of aldrinized fertilizers to control the soil pests has not yielded any promising results.

Studies on the bionomics and life history of some of the parasite species, especially **Coccophagus bogoriensis** kon., affecting the Green bug of coffee, were continued in the laboratory with a view to understand the parasite-host complex and its practical utility in the natural control of the pest.

MYCOLOGY

Field trials on spraying of coffee to find out efficient and economic methods of control and to evaluate the efficacy of various proprietary fungicides as compared with the standard Bordeaux mixture in controlling the major diseases of coffee and fundamental work on the life history and possibilities of control of the common diseases were continued A series of tests with low volume spray equipment were undertaken to find out if an economy in spray mixture could be effected without impairing efficacy of disease control.

Trials extending over a period of six years have conclusively brought out the superiority of half per cent strength of Bordeaux mixture over lower concentrations in controlling the leaf disease. The addition of detergents, wetters, spreaders and adhesives did not materially add to the efficacy of Bordeaux mixture.

Comparative spray trials using various proprietary fungicidal formulations have shown that the Bordeaux mixture, now in general use, is as effective and in some cases better than the products tried. Trials with newer formulations have been started during the year.

Trials to determine the optimum time of spraying Bordeaux mixture in North East monsoon areas and the use of chemicals in controlling monsoon leaf shed have been started and are in progress.

The trial of as many as five types of low volume nozzles against the standard high volume high pressure spraying equipment has shown that though they effected some economy in spray mixture, considering the extra time required it is not economical under the present conditions.

Studies on the control of the " damping off " disease caused by Rhizoctonia in the nursery showed that pre-treatment of seeds with mercurial seed dressings, soil sterilization with formaldehyde three weeks prior to sowing and monthly drenching of nursery beds and basket plants with Bordeaux mixture afforded the necessary protection.

Detailed studies on the Brown-eye-spot disease showed that the causal organism has no specialization regarding the arabica varieties, and that the disease is active during the rainy months reaching a peak incidence in October-November. The incidence and resultant defoliation are more severe on the young plants, and monthly applications with different fungicidal formulations afforded considerable control of the disease.

GENERAL

The Research Department of the Coffee Board has accepted the offer of the Indian Council of Agricultural Research, New Delhi, regarding the setting up of a "Soil Testing Laboratory " at the Coffee Research Station, Balehonnur, under the scheme for expanded soil testing service of the United States of America Technical Co-operation Programme and the Government of India.

The work of the soil testing centre will in the first instance be to undertake the analysis of a large number of soil samples from cultivators' fields and correlate it with the previous crop and cultivation practices. Based on the studies, the centre would render necessary advice in the laying out of fertilizer demonstration trials as well as application of suitable manures to coffee.

A project to investigate nursery and post-nursery diseases affecting young coffee in certain areas, especially South West Mysore has been started. A preliminary survey of such areas with particular reference to incidence and intensity is in progress. It is proposed to take up periodical observations in selected estates in this area. Inter alia, cultural, chemical, and biological control techniques will be studied.

A special project for testing of proprietary pesticides and fungicides on field scale in the various coffee zones has recently been sanctioned. This would enable their subjection to comprehensive and extensive tests both in the laboratory and in the field by specially trained staff, before they are recommended for the control of pests and diseases affecting coffee. The tests will normally be carried over a period of three years and the results will be published as and when they are available for release.

A pilot scheme to investigate the possibilities of sprinkler irrigation on coffee has been taken up. The experiments have been designed to study the influence of intensity and number of applications over a period of 5 months from November to March, applications being made at monthly intervals. The comparative economics of night irrigation against day irrigation will also be examined with a view to minimise loss in application and thus obtain greater effective use of available water. Concurrent studies on the fertilizer requirements and light intensity and shade requirements are also recommended.

Station Selections bred to leaf disease resistance, even bearing and high yielding qualites have been under distribution to selected zones from 1938 to 1946. As a result of the planters' re-action to these welcome characteristics of the selections, increasing issue of seed material has been undertaken from 1946 to the year of report An exploratory survey of the spread of these selections revealed that nearly 28,000 acres had been planted to these selections and that at least 5,000 acres had come to bearing.

In the light of the increase in production of coffee in India and the possibility of assured internal and external markets, a critical study of the field performance of the selections was taken up as a co-ordinated project of the liaison and plant breeding divisions of the Department. The study in particular refers to the following five factors, viz., growth characteristics including the incidence of pests and diseases in the nursery and post nursery stages, response to blossom showers, yield performance, out-turn in grade percentages of the cured product and quality of final produce (raw, roast and liquor qualities).

As a first step in this direction bulk samples of S. 288 and S. 795, the two major selections in large scale planting were prepared from plots of selected estates in Chikmagalur and Coorg districts in Mysore State. A quantity of 5 tons of 'A' grade coffee from these two station selections have been despatched to London for obtaining market reactions and inter alia tasters' reports on raw, roast and liquoring qualities of these new introductions. The project envisages the obtaining of such market reaction reports from the other coffee consuming countries on the European Continent and the United States as well.

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PART IV

SECTION REPORTS

I. AGRONOMY

The main work of the Agronomy Section consisted of germination studies in coffee, cultural trials to find out the effect of different cultural operations and seasons on the yield, manurial trials with and without pruning on Robusta, observational studies on the extent of retention of berries as well as estimation of the crop, and trial of a new method of planting coffee (Brazilian system). Two trials to find out the effects of mulching and growing green manure and cover crops, with and without manuring on young coffee were newly started during the year.

FIELD EXPERIMENTS

I. STUDIES ON THE INFLUENCE OF VARYING SOIL CULTIVATION PRACTICES ON THE YIELD OF ARABICA COFFEE

(a) Soil cultivation experiment - Coffee Research Station, Balehonnur

This trial started in July 1954 on old Arabica coffee was continued Different methods of soil cultivation such as trenching, renovation pitting, light and deep digging in two seasons of the year are compared against control which is given weeding only. The yield data of the experiment are given in Appendix VIII.

The yield differences for the past three years have not been significant. The two depths of trenching in the first two years and renovation pitting in the third year have, however, given numerically higher yields. The plots receiving weeding only (i.e. Control) are found equal, if not superior to both types of digging The experiment is being continued.

(b) Soil management experiment - Coffee Research Station, Balehonnur

This experiment was started in July 1954 with the object of studying the effects of digging to different depths in three seasons of the year on the yield of coffee. The experiment is laid on old arabica coffee planted at a spacing of 5 feet by 5 feet and receives all other operations in common excepting the treatments. The yields of coffee, both cherry and clean, for the past three years are presented in Appendix IX.

The treatment differences during the year are not significant. The yields are generally low in view of the past heavy crop and the general debility of the bushes due to leaf disease in the previous season. The control plots, receiving periodical weedings, are leading closely followed by plots receiving a light digging in August. In the previous year, light digging in November contributed to higher yields. Scuffling in April, on the other hand, gave the lowest yields in the past two years with the exception of control in the year 1955-56.

The experiment is being continued.

II. MANURIAL EXPERIMENT ON ROBUSTA - COFFEE RESEARCH STATION, BALEHONNUR

The fertilizer trial was laid out in the year 1951 with a view to study the effect on yields of varying levels of nitrogen with fixed applications of phosphorus and potash. The roubsta trees

in the plot are planted at a spacing of 8' x 8' and are about 25 years old. Half the dose of nitrogen is applied during the pre-blossom and the other half, along with the full quantity of phosphoric acid and potash, is applied in the post-monsoon period. The two levels of nitrogen under trial are 40 and 80 lb. to the acre while the rates of phosphoric acid and potash are 30 and 40 lb. respectively.

The yield data of the experiment are furnished in Appendix X. The yield figures for the past five years show no significant differences between the two levels of nitrogen. In four years, plots receiving 40 lb. nitrogen were leading while in the year 1955-56, application of 80 lb. of nitrogen gave numerically the highest yield Analysis of the data for studying the interaction of seasons also showed that the response to treatments has varied from year to year.

The experiment is being continued.

III. ROBUSTA MANURIAL AND PRUNING EXPERIMENT—PRIVATE ESTATES

Two experiments were laid out during 1952 in private estates viz., at Bhadra and Devadhanam, on the same lines, as in the robusta trial at the Coffee Research Station, Balehonnur. These experiments were further extended to study the influence of light pruning on the yields of coffee. The coffee bushes are of medium age and are planted at a spacing of 8' x 8'.

The two levels of nitrogen viz., 40 lb. and 80 lb. to an acre are applied in two split doses during pre-plossom and post-monsoon seasons. The fixed levels of phosphoric acid and potash at 30 and 40 lb. to the acre respectively are applied during the post-monsoon season. Pruning is given in the pre-blossom period.

(a) The yield data of the experiment at Bhadra Estate are given in Appendix XI. The yield data over the past four years have not given any significant results. In three years, plots receiving 40 lb. nitrogen either alone or in combination with pruning contributed to the highest yields while in the year 1956—57, plots receiving pruning only registered the highest yields. A combined analysis of the data for the past 5 years showed that the response to treatments had varied from year to year.

The experiment is being continued.

(b) The yield data of the trial at Devadhanam Estate are furnished in Appendix XII. The yield differences during the past four years are not significant. The response to different levels of nitrogen and pruning have varied from year to year. However, manuring with 40 lb. combined with pruning has contributed to higher yields in the past two years.

The experiment is being continued.

IV. EXPERIMENT ON THE INFLUENCE OF TOPPING ON GROWTH AND YIELD OF ROBUSTA COFFEE - BYREGUDDA ESTATE, BALEHONNUR

This experiment was laid out at Byregudda estate, Balehonnur, in the year 1951 to study the effect of topping robusta plants at 3 and 4 feet heights respectively. The plants at the time of the treatment were three years old. Growth measurements were recorded at periods of maximum and minimum growth, viz., June and November. The yields are recorded from 1955—56, the first year of bearing. In addition, stem girth measurements are also taken from this year onwards.

The data are presented in Appendix XIII. The growth increments over a four-year period showed that the plants topped at 3 feet height have registered better growth in the past three years but during the year 1955-56, plants topped at 4 feet height have shown better growth. Since the bushes have covered completely rendering recording of length difficult, measurements of length of branches have been discontinued.

The first yield in this experiment was recorded in the year 1955 – 56. Though in both the years, the plants topped at 4 feet height have registered numerically higher yields, the differences are not significant.

The experiment is being continued.

V. MULCHING TRIALS ON YOUNG ARABICA COFFEE

Two new trials were started during the year 1957 to find out the effect on growth and yield of young arabica coffee by mulching, growing green manure and cover crops. Arabica selections planted in the year 1954 in L_3 block of the Coffee Research Station, Balehonnur were selected for the purpose.

(a) Mulching experiment - Coffee Research Station, Balehonnur

This experiment has been laid to find out the effects of mulching, growing cover and green manure crops on the growth and yield of young coffee. The mulch was applied in the middle of March 1957, and the green manure and cover crops were sown in the last week of April. Seeds of **Crotalaria anagyroides** and **Calopogonium mucunoides** were used for the above purpose.

Initial stem girth measurements were recorded on 18—3—1957. Observations on general health, vigour and freedom from pest and diseases were continued. Details of layout are furnished below —

Locality : Coffee Research Station, Balehonnur.
Year of commencement : 1956—57.
Design : Randomized blocks. Variety : Arabica Selections.
Treatments : Six Replications : Four
Plot size : Gross — 35 plants (2.89 cents)
Net — 15 plants (1.24 cents)

Total area under the experiment : 0.67 acre.

The six treatments are as follows :—

A. Control (No mulch)
B. Mulching with dry leaf at 3 tons per acre.
C. Mulching with cherry husk ,,
D. Cover cropping.
E. Green manure before monsoon
F. Green manure after monsoon.

The experiment is being continued.

(b) Mulch cum manuring experiment - Coffee Research Station, Balehonnur

This experiment has been laid tc find out the effects of mulching, with two levels of nitrogen, on the growth and yield of young coffee.

The mulch was applied in the middle of March 1957 and the differential doses of nitrogen along with pre-blossom manuring on 23—3—1957.

Initial stem girth measurements were recorded on 11—4—1957. Observations on general health, vigour and freedom from pest and diseases were continued.

Details of layout are furnished below:—

Locality	:	C. R. S., Balehonnur.	Year of commencement :	1956	57.
Design	:	Randomized blocks	Replications :	4	
Treatments	:	Six	Variety :	Arabica selection.	
Plot size	:	Gross — 35 plants (2 89 cents)			
		Net — 15 plants (1.24 cents)			

Total area under experiment : 0.69 acre.

The several treatments are as follows :

A. Manured @ N. P. K. 20—30—40
B. Manured @ N. P. K. 40—30—40
C. Manured as in A. + dry leaf mulch @ 3 tons.
D. Manured as in B. + dry leaf mulch @ 3 tons.
E. Manured as in A. + Cherry husk mulch @ 3 tons.
F. Manured as in B. + Cherry husk mulch @ 3 tons.

The experiment is being continued.

VI. OBSERVATIONAL STUDIES ON BLOSSOM—BERRY CORRELATIONS

A Studies on the percentages of berrries carried by some of the important Station Selections, commenced in April 1955, were completed in October 1956. The data are presented in Appendix XIV (a) & (b).

It is seen from the data that though initial set as observed by April figures varied from 87. 98 to 82.03 per cent, the extent of berries maturing on the plants in October ranged from 40 85 to 49.16 The lower figures in the year 1955 are the result of a low percentage of crop carried by the Kent plants, due to leaf disease. In the year 1956, on the other hand, the Kent plants being relatively free from leaf disease, carried a higher percentage of berries resulting in increased mean percentage of berries maturing in October. It may, therefore, be concluded that the extent of crop carried to maturity besides being affected by seasonal conditions, is also influenced by the general health and vigour of the plants.

B. Studies on crop estimation

This pilot study is intended to devise a more accurate method of estimating the crop than the erstwhile system of " eye " judgement. From each estate, five blocks were chosen at random and from each block five trees. The number of bearing branches in each selected tree were counted and five representative branches representing the top, middle and bottom portions

of the plant were utilised for counting the number of spikes / blossom / berries as the case may be. From these the yield per acre for the block and then for the estate were estimated after adjusting the yields with suitable correction factors. The estimate of crop based on the above studies at monthly intervals as well as by the usual method are furnished below :

CROP ESTIMATION STUDIES

Serial No.	Crop	Estimate of crop in tons during 1957					Estimate by general method on blossom
		Febry. Spike	May Blossom	June	July	August	
Coffee Research Station, Balehonnur							
1.	Arabica	45.23	34.27	32.83	46 87	37,52	13.00
2.	Robusta	41.35	33.86	18.00	16,44	13.01	7.00
Coffee Research Sub-station, Chethalli							
3.	Arabica	30.14	36.10	43.21	68.40	72.72	46.00

From the above studies it is seen that the estimates of crop by the new method is on the high side when compared to the normal method of estimating the crop on the blossom. The steep rise in the estimates in July in respect of arabica is due to a higher correction factor employed whereas in the case of robusta the trend is showing a gradual decrease as the season progressed.

VII. STUDIES ON THE GERMINATION OF COFFEE SEEDS

Coffee Research Station, Balehonnur

Experiments to find out the viability of seeds on storage, the method and kind of storing the seeds, methods of preparation of seed beds and pre treatment of seeds to hasten germination were under study. The results of germination experiments being in the nature of discrete variates analysis of variance were made with transformed data. The transformed values alone have been presented in respect of items (b) to (f).

(a) Seed viability studies on robusta

Bulk seeds of robusta prepared under similar conditions as in the estate were sown at fortnightly intervals to study the extent to which germination is affected by storage. The data as average of four replications is given below.

Sl. No.	Date of sowing.	Percentage of germination
1	25—2—1957	96.75
2	11—3—1957	90.00
3	25—3—1957	87.88
4	8—4—1957	80.75
5	22—4—1957	74.50
6	6—5—1957	71.63

It was observed that robusta seeds sown immediately after preparation registered as high a percentage of germination as 96.75. A progressive fall in the germination percentage was seen as

sowings were delayed but there were no differences in the time taken to show first signs of germination in respect of the various dates of sowing.

(b) Studies on the methods of preservation of seeds

Bulk seeds of robusta were prepared and treated in four different ways as follows and fortnightly sowings were done to find out the effectiveness of treating the seeds.

Treatments :

A. Control - No treatment.
B. Seeds preserved in naphthalene.
C. Seeds preserved in charcoal.
D. Seeds preserved in ash.

The results are presented in Appendix XV.

Seeds sown immediately after treatment did not show any significant differences in the percentage of germination. In respect of later sowings, seeds preserved in charcoal gave significantly higher germination percentages except in the third sowing when it was on a par with the control. Treating seeds with ash or preserving them in naphthalene followed closely but were inferior to treatment with control.

(c) Studies on the methods of storage of seeds

Bulk seeds of arabica and robusta prepared in the usual manner with ash were stored by the following four methods and fortnightly sowings were done to find out the best method of storage of seeds.

Treatments :

A. Control - seeds stored in gunny.
B. Seeds stored in tins.
C. Seeds stored in cloth bags.
D. Seeds stored in alkathene paper.

The results are presented in Appendix XVI.

In respect of arabica, results of 4th and 6th sowings alone were significant. The conclusions were, however, conflicting in that by the former, storing of the seeds by all the methods were superior to control while in the latter control was on a par with storing in tins or cloth bags but was superior to storing in alkathene bags.

In respect of robusta, the results of second and third sowings were conclusive and that all the three methods of storing in gunny and cloth bags and in tins were superior to alkathene bags but were on a par among themselves.

It may be concluded from the above that though no differences existed between the several containers, alkathene bags were inferior to the other three.

(d) Germination of arabica and robusta seeds as affected by composition of nursery beds

Bulk seeds of arabica and robusta prepared in the usual manner were sown in seed beds prepared with ordinary soil, jungle soil and sand, alone or in different proportions. The design

was a randomized replicated one with six treatments and four replications Seeds of arabica and robusta were sown on 9—2—1957 and 26—2—1957 respectively. The number of seeds sown per plot was 200. The results of the experiment are presented in Appendix XVII.

It is seen that the differences in germination percentages in respect of both arabica and robusta are not significant. The slightly lower percentages of germination in arabica are due to the longer time the seeds have been in storage. However from a comparison of the treatments, it may be concluded that increased proportions of jungle soil and compost have given higher percentages of germination.

(e) Pre—treatment of seeds

Seeds of arabica and robusta were treated with two strengths of Sulphuric acid for three and five minutes and with different growth promoting hormones at 15 ppm. for 24 hours. Seeds with and without parchment cover were treated. The seeds were sown in a randomised replicated trial with eight treatments and four replications. Seeds of arabica and robusta were sown on 12—2—1957 and 23—2—1957 respectively. The number of seeds sown per treatment was 200. The results of the experiment are furnished in Appendix XVIII.

The treatment differences, in respect of all the four trials with arabica and robusta and with and without parchment cover were significant.

Treatment of clean coffee i e., seeds without parchment cover of both arabica and robusta with both the concentrations of sulphuric acid for three and five minutes respectively gave generally very low percentages of germination. This was due to the death of the embryo caused by the acid. Where the seeds with their parchment covers were treated, it was seen that dilute acid was better than concentrated acid and that soaking seeds for 5 minutes gave better results than soaking them for 3 minutes.

Among the four growth-promoting substances (chemicals) under trial, it was seen that treatment of clean coffee gave an average of 6.7 per cent more germination than treating coffee with the parchment cover on ; but this increase is not likely to be commensurate with the labour involved in the operation. With either clean or parchment coffee, no differences among the chemicals were noticed.

Along with the above studies, higher concentrations of the four chemicals were used in an observational trial to find out the effect on germination of seeds of arabica and robusta with their parchment cover on. The results are furnished in Appendix XIX.

In the case of arabica, it is seen that an increase in the concentration of the chemicals has led to gradual decline in the percentage of germination. Indole acetic acid and Indole butyric acid increased the percentage of germination, while the effect of alpha Naphthalene acetic acid on the seeds was the poorest.

The lower and higher concentrations viz., 25 and 100 ppm. of the chemicals caused better germination than 50 ppm. Indole butyric acid and alpha Naphthalene acetic acid gave greater mean percentages of germination while the effect of 2, 4-D was the poorest.

(f) Methods of drying seed coffee and their effect on germination

An experiment was started during the year to study the effect of drying seed coffee in the shade (normal estate practice) as against drying in the sun. The seeds of arabica coffee were dried by the above two methods to a constant moisture level. Monthly sowings were done to find out the effect of the method of drying as well as that of storing the seeds. The trial was laid out in randomized replicated method with five replications. The number of seeds sown per treatment was 100. The results are presented in Appendix XX.

It may be seen from the results that where the parchment cover has been removed, there has been a gradual decline in the rate of germination. On the other hand, where the cover was not removed, there was an increase in the percentage of germination upto four months of storage after which there was a steep decline. Shade drying of the seeds contributed to a higher percentage of germination when compared to sun-drying.

VIII. TRIALS WITH GIBBERELLIC ACID

Gibberellic acid, a plant growth-promoting substance, has shown a wide range of growth stimulation and acceleration in many types of plants ranging from ornamentals, flowers, food and forest plants. Specific results such as stem elongation and growth increase, breaking of dormancy, induction of flowering, increasing fruit setting and prevention of growth-retardation at transplanting have been attributed due to the treatment with this chemical. In order to test the efficacy of the chemical on coffee, three observational trials have been started during the year and are in progress. The details are as follows :

(a) Seeds of arabica coffee were treated with 10, 25, and 50 ppm. of the substance by soaking the seeds in the solution overnight for 24 hours. Fifty seeds were used per treatment and the layout adopted was a randomised replicated design with four replications. Seeds were sown on 26—6—1957 and observations are in progress.

(b) Single noded leafy cuttings from the 1st, 2nd, 3rd, and 4th nodes of shoots of coffee were treated by dipping the cut ends in 10, 25, and 50 ppm. of the substance for 24 hours. These cuttings with controls were planted in the propagation chamber on 26--6—1957. Twenty cuttings were used per treatment. Observations are in progress. Side by side with this, cuttings were treated with 10, 50, and 100 ppm. of the substance for 3 minutes (quick dip) and planted for observational studies.

(c) Transplanted seedlings of arabica coffee were treated with 10, 50, and 100 ppm. of the substance 10 days after transplanting and again three weeks later. The substance was applied both to the soil and on the plants as spray. Observations are in progress.

IX. BRAZILIAN SYSTEM OF PLANTING

One acre of newly opened area at the Coffee Research Station, Balehonnur, was planted according to the Brazilian method, but retaining shade, during the year 1956. Pits of the same dimension as under our conditions were opened at a spacing of 13 x 8 feet. Four seedlings of S.795 (a selection of arabica) were planted in each pit. While a majority of the pits were

fully closed and the seedlings planted in the middle, 75 pits were only half filled with soil and the seedlings planted in the hollow. It is hoped that by the latter method, adequate protection against wind and sun will be obtained. A thick stand of green manure was raised by sowing **Crotalaria striata** and the rows between coffee were heavily mulched by cutting and spreading the green manure.

EXPERIMENTS AT THE COFFEE RESEARCH SUB-STATION, CHETHALLI (COORG)

(a) Cultivation Experiment

A trial similar to the one at the main station was started in the year 1953 on mature arabica coffee at Chethalli. Different methods of soil cultivation and light and deep digging are under comparison against control, which is given weeding only. The yield data of the experiment is given in Appendix XXI.

The yield differences for the past three years have not given any significant results. The experiment is being continued.

(b) Studies on the shade requirement of arabica coffee

An experiment to find out suitable types and combinations of shade trees for optimum growth of arabica coffee was laid out in 1955-56 in a newly cleared area.

Locality : Coffee Research sub Station, Chethalli (Coorg)

Treatments : 10 (constituted by grouping nine out of the following ten shade trees for each treatment omitting one at a time)

1. **Ficus glomerata** (Atti)
2. **Ficus nervosa** (Malaigargathi)
3. **Dalbergia latifolia** (Beete)
4. **Pterocarpus marsupium** (Honne)
5. **Eugenia jambolana** (Nerale)
6. **Artocarpus heterophyllus** (Jack)
7. **Ficus** sp. (Elibasari)
8. **Albizzia lebbeck** (Kalbage)
9. **Bischofia Javanica** (Neeli)
10. **Ficus retusa** (Mitli)

The treatments are :—

A. Neeli omitted
B. Jack omitted
C. Malaigargathi omitted
D. Mitli omitted
E. Kalbage omitted
F. Beete omitted
G. Nerale omitted
H. Honne omitted
I. Elibasari omitted
J. Atti omitted

Replications : Six. Layout : Randomized

Plot size : 12 x 12 - 144 plants in a sub-plot with one shade tree in the centre of a group of 4 x 4 = 16 coffee plants.

Plant material : S. 795 arabica.

Planting distance : $6\frac{1}{2}$' x $6\frac{1}{2}$' for coffee.
26' x 26' for shade trees.

Observations to be recorded :—

(1) Growth and development of coffee plants.
(2) Yield.
(3) Disease and pest incidence.

Temporary shade has been provided all over the area uniformly by planting the same number of dadap stakes in each plot. All the plots were manured uniformly.

B. S. KUPPUSWAMI
Agronomist,

II. BOTANY.

Inter-and intra-specific coffee breeding work to combine resistance to leaf disease (**Hemileia vastatrix** B & Br.) and high yields were continued. (1) Collection and establishment of species, varieties, types and forms of coffee from countries outside India and from South Indian coffee estates, (2) comparative trials on clonal progeny of good bearers and, seedling progeny of selections and crossbreds for finding out the behaviour of the progeny regarding resistance to leaf disease and yield, (3) morphological and cytological studies, (4) organisation of seeds and seedlings supply from approved selections to growers, (5) experimental work on vegetative propagation of coffee by grafting and rooting of cuttings, and, (6) collection and establishment of shade tree species from sources outside India formed the principal work of the Section.

Coffee seeds were obtained during the year by courtesy of (1) The Head, Plant Introduction Section, Horticultural Crops Research Branch, U.S. Department of Agriculture, Beltsville, Maryland, (2) Director, Instituto Agronomico Do Estado De S. Paulo, Campinas, Sao Paulo, Brazil, (3) Officer-in-charge, Coffee Research Unit, Kawanda Research Station, Kampala, Uganda, (4) Chief Research Officer, Agricultural Department, Government of the Union of Burma, and, (5) Director, Experimental Station, C P.V., Proefstation Der Centrale Proefstations Vereniging, Bogor, Indonesia.

Shade tree seeds were obtained during the year by courtesy of (1) Director of Agriculture Department of Agriculture, Kenya, and, (2) Shri K. Keshavagopal Naidu, Deputy Conservator of Forests, N. Andamans.

A. COFFEE BREEDING.

I. Arabica

With a view to evolve disease resistant, high yielding and vigorous strains, cross-breeding of arabica coffee was continued. 13 new crosses were effected during the year. They include the crossing of S. 795 with S. 178 and with a wild arabica collection from Anglo-Egyptian Sudan exhibiting a marked resistance to leaf disease, the crossing of third generation of S. 26, a primary mother plant of this Station, with K. P. 423 a high yielding Kents arabica selection from Lyamungu, Moshi, Tanganyika, on the one hand, and with the first generation of S.44 showing resistance to races I, II and III of leaf disease on the other. 6 crosses established in the earlier years possessing the desirable characteristics enumerated above were selfed for raising further progeny. Selfed progenies were being raised to continue studies on field performance of the crosses established out of selected parents earlier

2. Field studies of advanced generations of Selections and hybrids

In the observational trials started in 1952 with (i) progeny of six selected plants of S. 795, (ii) F2 of S. 26 X Kents arabica, (iii) selected plants from S. 333, and, (iv) 5 intra-crosses of arabica cultures, it was noticed that progeny from 3 of the 6 selected plants in S 795 showed over 25% leaf disease in the field. F_2 of S. 26 X Kents arabica showed an equally high percentage of leaf disease being nearly 47%. These have been discarded from further trials.

FIG. 1

S 795 (IInd Gen. 5 years Old)

FIG. 2

Arabica (B A Series) Varietal Trial

FIG. 3

F1 of S. 274 Robusta selection and Kents Arabica

FIG. 4

3 Year Old Robusta Coffee
under conversion to Arabica by grafting
(Top-working)

Except 3 out of 5 intra-crosses of arabica cultures which have exhibited freedom from disease so far, all the other materials were more or less susceptible to the disease, the range varying from as low as 1. 6% in the case of the progeny of S. 795 to as high as 19% in the case of progeny of S. 333.

In the 1953 series consisting of 11 cross-breeds and 3 hybrid collections from neighbouring estates, it was interesting to observe that six cross-breeds and the three hybrid collections appear to be free from leaf disease. The remaining 5 cross-breeds show susceptibility varying from 5% to 17%.

Progeny of 3 intra-crosses out of 11 between arabica cultures planted in 1954, continued to show so far freedom from leaf disease. One (progeny of S. 373, 1/3 X S. 333-14) showed 40% susceptibility and has therefore been discarded. The others have shown varying susceptibility from 2. 7% to 12%.

In the case of the 9 intra-crosses between arabica cultures planted in 1955, 8 crosses exhibited leaf disease susceptibility varying from 4.7 to 11. 3%. Only one intra-cross in this series and F 2 generation of arabica selection cross-bred with Kents arabica planted at the same time continued to keep free from disease.

In the 1956 series, 4 out of 16 intra-crosses between arabica cultures planted in 1956 are so far free from disease. The rest of the 16 crosses and progeny of S. 846 and S. 795 were exhibiting varying degrees of suceptibility to disease.

3. Comparative trials of seedling progeny from Selections of B. A. Series

A trial was laid out during 1956 with seedling progeny of 20 arabica cultures of B.A. series on lines similar to that followed in Coffee Research and Experimental Station, Lyamungu, Moshi, Tanganyika. Details of the experimental design were very kindly furnished by the Chief Research Officer, Coffee Research & Experimental Station, Lyamungu. According to this technique, to determine the degree of variation between progenies and within progenies, it has been established that single tree plots of seedlings are adequate provided a clone of known range of yield is used as 'key' plots. Details of the trial laid out at Balehonnur are given below :

Locality : C. R. Station, Balehonnur.

Treatments : (i) 20 cultures of the B. A. series — seedling progeny.
(ii) Two clones for comparison — clonal progeny.

Plot : Single plant.

Replications : (i) Seedling cultures replicated 30 times.
(ii) Two clones for comparison replicated 30 x 4 times.

Guard row : One all round the experimental block using seedlings of S. 795.

Spacing : 6½ ft. x 6½ ft.

Shade : Natural shade.

Seedling progeny of 20 cultures of the B. A. series are :—

B.A. 1	B.A. 10	B.A. 17	B.A. 27
B.A. 3	B.A. 11	B.A. 19	B.A. 29
B.A. 6	B.A. 12	B.A. 21	B.A. 34
B.A. 8	B.A. 13	B.A. 22	B A. 35
B.A. 9	B.A. 14	B.A. 25	B.A. 36

Clonal progeny of 2 clones are S. 31 and S. 645.
The plants are so far free from leaf disease.

4 Comparative trials of clonal progeny from best performers

(a) **B. A. Series I.** The randomised replicated trial to test the comparative merits of 20 arabica cultures (B. A.5, 6, 11, 12, 13, 19 to 27, 30 to 32 and 34 to 36) planted in 1951 and 1952 was continued. The plants are so far free from leaf disease in the field. The average yield of the cultures in terms of clean coffee per acre is given in Appendix XXII.

(b) **B. A. Series II.** The randomised replicated trial to test the comparative merits of 16 arabica cultures (clonal progeny of B. A. 1, 4, 7, 8 to 10, 13 to 18, 28, 29 and 33 and seedling progeny of B. A. 19) planted during 1952 and 1953 was continued. All the plants are so far free from leaf disease in the field. The average yield of cultures in terms of clean coffee per acre is given in Appendix XXIII.

5. Observational studies on the performance of the progeny of outstanding plants selected from private estates : (Field collections).

(a) Of the 18 collections from Mysore State and Shevaroys (Madras State), described in the Annual Report for 1952-53, 4 collections from Mysore were found to show more than 20 to 25% susceptibility to leaf disease in the field. These have since been discarded. The remaining collections have shown susceptibility ranging from 5 to 13%. Further observations are in progress The crop harvested from these collections during the year under report has varied from 4.7 cwt. of clean coffee to the acre in the case of one collection from Mysore North to as low as 0.23 cwt.

(b) The plants from the collections in 4 estates from Shevaroys (Madras State) and one estate in Mysore State mentioned in the earlier reports showed a high degree of over 60% susceptibility to leaf disease Due to the disease, defoliation was also noticed to an appreciable extent in the case of the earlier three collections. It is interesting to observe that in the years 1954-55, and 1955-56 these showed a remarkably low percentage of leaf disease varying from 3 to 5.9 per cent.

(c) The plants raised from seeds of a plant in Woger Estate Mysore State), and from a hybrid plant of Kogilahalla estate, Coorg (Mysore State), collected in the previous year, were exhibiting a high degree of variation in vegetative characteristics, though all of them were vigorous in growth. Leaf disease susceptibility varied from 10. 6% in the case of the former to 38.6%in the case of the latter.

(d) Collection of seed material from outstnding plants in private estates was continued. 50 seedlings raised from seeds of two plants from Kotada estate (Nilgiris, Madras State) were planted at the Station during 1957.

6. Inter-specific crosses

(a) Study of inter-specific hybrids, with particular emphasis on the robusta-arabica hybrid, their back-crosses and self-bred progeny was continued. A co-ordinated study on cytological and morphological characteristics as well as leaf disease resistance and yield characteristics of these hybrids were initiated during the year. A list of inter-sepecific hybrids established at the Station from previous years is given in Appendix XXIV.

(b) Of the 5 existing plants of the second back-cross progeny with the noble parent Kents of S. 274 Robusta X Kents arabica, 3 plants showed a very slight manifestation of leaf disease (less than one per cent and in isolated spots). The plants are under observation.

(c) During the year the following crosses were effected:-

(i) Robusta X Congensis with either parents.

(ii) Two selected plants in the lst back-cross of S. 274 Robusta X Kents arabica with Kents arabica having 2 n = 44 chromosomes were back-crossed with Kents arabica (2 n = 44).

(d) **Devamachy Hybrid collections**: Of the 10 crosses between Devamachy hybrid collection and certain arabica selections and collections reported earlier, it was noticed that nearly 80 per cent of these crosses showed signs of susceptibility to leaf disease against the earlier observations of freedom from disease. Two of the crosses with Anglo-Egyptian Sudan collection continued to be free from disease so far in the field.

II. Robusta.

1. Comparative trials of seedling progeny from best performers

A trial was laid out during 1956 with seedling progeny of 12 robusta cultures of the B. R. series using the same design as for the seedling progeny of 20 arabica cultures of the B. A. series described earlier. Details of the trial laid out are given below:

Locality: C. R. Station, Balehonnur.

Treatments: (i) 12 cultures of the B. R. series - seedling progeny.
(ii) Two clones for comparison-clonal progeny.

Plot: Single plant.

Replications: (i) Seedling cultures replicated 27 times.
(ii) Two clones for comparison replicated 27 times.

Guard Rows: One all round the experimental block using seedlings of S. 274 robusta.

Spacing: 10 ft X 10 ft.

Shade: Natural shade.

Seedling progeny of the B. R. series are,-

B R. 1	B.R. 6	B.R. 11
B.R. 2	B.R. 8	B.R. 12
B.R. 3	B.R. 9	B.R. 14
B.R. 5	B.R. 10	B.R. 17

Clonal progeny of two clones are B.R.1 and B.R 11.

2. Comparative trials of clonal progeny from best performers

Comparative trials on field performance of clonal progeny from best performers started in 1951-52 with 10 robusta cultures of the B. R. series; and, of 9 robusta cultures of the B. R series and seedling progeny of S. 274 in 1952–53 were continued. Primary and initial crops were taken. Observations are in progress.

III. Collection of coffee seed material from countries outside India

Collection of seeds of coffee species, varieties and selections from countries out side India was continued.

(a) World Collections-1953 series

Seedlings of 5 varieties of arabica—Bourbon amarelo, Bourbon vermelho, Catura amarelo, Laurina maragogype and Mundo Novo, obtained from U. S. Department of Agriculture and planted during 1953 at the Balehonnur Station along with the progeny of Selection B.A. 1, B.A. 12, B.A. 16, and B.A. 19 continued to be under observation. Under the conditions at the Station, all the five introduced varieties and upto 10 per cent in the progeny of the B.A. selections showed susceptibility to leaf disease in the field. The introduced varieties also suffered from defoliation due to the leaf disease. A negligible crop was harvested from them during the year.

(b) **World Collections:—1954 Series:** The seedlings of 27 varieties of arabica raised from seeds received from Guatemala, Belgian Congo and Ethiopia, 7 arabica selections raised from seeds received from Coffee Research & Experimental Station, Lyamungu, Tanganyika, Kawisari B and D received from Indonesia, were planted at Balehonnur during 1954 with Station selections S 288 and S. 446, and are under continued observation. All the plants were protected with Bordeaux mixture spray as most of the collections and S 446 showed susceptibility to leaf disease in the field. S. 288 was comparatively free from the disease. Disease infection was observed to be very slight on the plants in S. 8 Tafari Kela and S. 12 Kaffa (Ethiopian Collections). These as well as San Ramon, Padang, Philippinean (Collections from Guatemala) and K.P. 423 (collection from Lyamungu Station, Tanganyika) are showing vigorous growth and are carrying a good crop.

(c) **World Collections — 1955 Series:** Seedlings of 42 varieties of arabica, Kawisari B and D., C. stenophylla, C.canephora, C. dewevrei excelsa, C. racemosa and C. ligustroides raised from seeds received from Liberia, Belgian Congo, Ceylon, Portugal and Tanganyika were

planted during 1955 at Balehonnur Station along with Station Selections. All the introduced arabica varieties except Wolkite and Arba Gougou (from Ethiopia) show susceptibility to leaf disease in the field. Species other than arabica have so far not shown leaf disease.

(d) **World Collections :—1956 series :** Seedlings of 66 varieties, forms and types of arabica and 6 species of coffee raised from seeds received from U.S. Department of Agriculture, Guatemala, Ethiopia, Liberia, Tanganyika, France and Ceylon were planted at Balehonnur Station during 1956. Among the arabica varieties Tafarikela and Eniamba Kaffa (from Ethiopia) have not so far shown leaf disease in the field. All the remaining arabica collections have shown leaf disease infection.

(e) The following seed material was received during the year under report from Institutions abroad and seedlings have been raised from them :

Material obtained	Source
Coffee arabica	
1 Geisha 1/1, 2/2 and 4/4	Head, Tropical Crops Plant Introduction Section, U S. Dept. of Agriculture, Horticultural Crops Research Branch, Beltsville, Maryland, U S. A.
2. Selections No. 11, 78, 298, 401 and 578 from aplantation in Puerto Rico.	
3. Columnaris No. 22 – 124 and 22 – 196	
4. B. E. 5, 6, 7, 8, and 9.	
5. Coffea congensis.	
6 Coffea kivuensis	
7. Rume Sudan Tree No. 13.	Officer – in – charge, Coffee Research Unit, Kawanda Research Station, Kampala, Uganda.
8. Barbuk Sudan Tree No. 7.	
9. Arabica X Liberica hybrids Tree No. 1/1, 2 4, 3/7, 4/9, 5/5 and 6/9.	
10. Coffea robusta IS/3, 2/52, and 2/13.	
11. Coffea congensis Tree No. 1	
12. Catura vermelho.	Director Instituto Agronomico Do Estado De Sao Paulo, Campinas, Sao Paulo, Brazil.
13. Bourbon amarelo	
14. Coffea robusta clones B. P. 39, 42 and S. A. 13.	Director, Exptl. Station C. P. V. Proefstation Der Centrale Proefstations Vereniging, Bogor, Indonesia.
15. Coffea arabica.	Chief Research Officer, Agricultural Department, Rangoon, Burma.

(f) Collection of coffee material received so far since 1953 from institutions outside India and planted out in the field at the Balehonnur Station, consists of 114 varieties, forms and selections of arabica coffee, 4 types of liberica, 10 types and selections of robusta coffee, 2 types of excelsa coffee, Kawisari B and D, congensis, stenophylla, eugenoides, racemosa, salvatrix and kapakata. A list of species, forms and selections so far received is given in Appendix XXV.

B. EXTENSION WORK WITH SELECTIONS.

1. Seed Blocks

(a) The seed blocks established at Balehonnur Station with S. 795, S. 947, S. 645 and S. 846 during 1954 and with S. 795 during 1955 were maintained The plants, particularly S 795, are showing vigorous and healthy growth. Crop on brown wood has been allowed to develop on S. 795 planted during 1954.

(b) The scheme of establishing zonal seed plots of Station Selections on private estates initiated during 1954–'55 to help in meeting the increasing demand for seed coffee of Station Selections was continued. During the year, seed coffee was collected in the zonal seed plots established in the following estates:

Mysore State

1. Bagneheddal estate, Chikmagalur P. O.;
2. Mandalkhan estate, Santaveri P. O.;
3. Yellikodige estate, Aldur P O.;
4. Urvinkhan estate, Javali P. O ;
5. Bettadamane estate, Mudigere P. O.;
6. Archullie estate, Mudigere P. O.;
7. Barguai estate, Sakalaspur P. O ,
8. Kogarvalli estate, Sakalaspur P O.;
9. Daithapura estate, Ballupet P. O.;
10. Kibbetta estate, Somwarpet P. O.;
11. Balagunda estate, Somwarpet P. O.;
12. Madapur 'A' estate, Madapur P. O.;
13. Haradoor estate, Suntikoppa P. O.;
14. Pannia estate, Suntikoppa P. O ;
15. Cannoncadoo estate, Sidapur P O.;

Madras State

16. Glenvans estate, Ouchterlony Valley Estates (1938) Ltd., New Hope P. O. (Nilgiris); and
17. Cauverypeak estate, Yercaud P O. (Shevaroys).

Off type plants in these seed plots were rogued out and seed coffee was prepared under the supervision of the Department.

2. Seed distribution :

(a) During the year 5, 318 lb. seeds of arabica selections, 341 lb. seeds of robusta selections and 26 lb seeds of excelsa were supplied to growers from seed prepared at the two Research Stations.

(b) 55 lb. seeds of arabica selections were supplied to (1) Senior Research Officer, Coffee Research and Experimental Station, Lyamungu, Moshi, Tanganyika, (2) Directeur, Institute

National Pour L 'Etude Agronomique Der Congo Belge, Station De Rubona, Belgian Congo, (3) Expert Cafe de la F. A. O, Mission de l 'Expert Cafe en Ethiopia, F. A. O. of the U. N. O., Addis Ababa, (4) Directeur, Service De L 'Agriculture, Agricultural Research Station, Bealanana, Madagascar, (5) Officer –in—charge, Coffee Research Unit, Kawanda Agricultural Research Station, Kampala, Uganda, (6) The Agricultural Officer, Bvumbe Tung and Agricultural Experiment Station, Limbe, Nyasaland (7) Directeur, Instituto Agronomico Do Estado De Sao Paulo, Campinas, Brazil, (8) Philippines Bureau of Plant Industry, Manila (through the good offices of the Procurement and Supply Officer, Technical co-operation Mission to India, American Embassy New Delhi), and (9) Dr. Howard L. Hyland, Plant Procurement Section, U. S. Department of Agriculture, Beltsville, Maryland, U. S. A. (through the good offices of the Counsellor (Agricultural), American Embassy, New Delhi).

(c) 8079 lb. seeds of arabica selections collected from zonal seed plots in estates were supplied to growers.

(d) During the year under report, 2034 planters were supplied with 13,397 lb. seeds of arabica selections, 341 lb. seeds of robusta selections and 26 lb. seeds of excelsa, from the two Research Stations and the 17 zonal seed plots. This quantity of seed material is considered sufficient for planting on an area of 13,397 acres with arabica selections and 682 acres with robusta. selections at the rate of 1 lb. to an acre in the case of arabica and ½ lb. to an acre in the case of robusta. Appendix XXVI shows the progressive increase in the supply of seed coffee of Station Selections from the year 1949.

3. Regional Seedling Nurseries

Twenty five regional seedling nurseries in private estates in 7 Liaison zones and at the two Research Stations functioned during the year under report for supply of seedlings from these to planters in the immediate neighbourhood. 1,18,116 seedlings of arabica selections and 44,000 seedlings of robusta selections raised in these nurseries were supplied to growers.

C. VEGETATIVE PROPAGATION.

1 Grafting :

As stated in the earlier reports, trials to find out an easy technique for grafting on robusta stock or moribund or diseased hybrid stock were continued.

Top working at varying heights from 2 ft. to 2½ ft. from ground level, grafting on suckers raised from stumped robusta and grafting on green tender suckers on mature robusta without stumping were undertaken. It was noticed that in the earlier case of top-working it was more advantageous to effect grafts at the lower levels of 6 to 9 inches This showed comparatively better growth.

Attempts at grafting in the earlier instance were with a sucker which had been raised in the previous year and allowed to mature over a period of 8 to 9 months. It was found that it was equally possible to effect successful ' takes ' of grafts with tender suckers of not more than 2 to 3 months' growth thus effecting economy in time and care. These trials are being continued.

Earlier fieldscale operations in a few estates in rehabilitating by grafting techniques resulted in further extension of this work to a few private estates. Grafting demonstrations for estate workers and others were held as in last year at both the Research Stations in the last week of May and the first week of June, 1957. Over 50 visitors attended it at each of these sessions

2. Rooting of sucker cuttings

(a) 1,666 rooted cuttings from (1) 36 arabica selections of the B. A. series, (2) 17 robusta selections of the B. R. series, and (3) S. 26, S. 31, S. 46, S. 645, S. 795 and Kents arabica were produced during the year. They were utilised for planting in experimental plots.

(b) Two proprietary products, Seradix L. 15 and L. 30 were compared with Cow's urine extract in treating the sucker cuttings before inserting them for rooting. While treatment with Cow's urine extract gave 78.9% rooting, that with Seradix L. 15 and L. 30 recorded 75·6% and 76.7% rooting respectively.

D. MULTIPLE Vs SINGLE STEM SYSTEM OF GROWING COFFEE.

Training coffee on multiple stem is a common practice in Central American and East African coffee areas. The main advantages appear to be regular and controlled cropping and simplicity of pruning. With a view to gain local experience and knowledge, four sets of experiments were laid out at Balehonnur in 1950 and 1951 to compare the single stem and multiple stem systems of growing coffee — both arabica and robusta. Unlike in other countries, the coffee in these experimental plots is grown under shade.

(a) **Arabica**: Appendices XXVII, XXVIII and XXIX summarise the yields obtained from these trials with arabica. It is seen that irrespective of the experimental technique, the multiple stem coffee has given a numerically increased yield upto 9%. Further observations are in progress.

No stem borer infestation was observed on the plants as an effective protection was provided with B. H. C. application.

(b) **Robusta**: This experiment started in 1951 as described in our earlier reports, was continued. The fifth crop after conversion was recorded. The data are given in Appendix XXX.

On the aggregate of five years yields, the single stem plots have recorded 69% increase over the multiple stem plots. Shot hole borer infestation on the multiple stem plants continued to be heavy as in the previous years and a number of branches had to be removed and destroyed.

E. LABORATORY STUDIES.

Cytological studies were contiued to define the chromosomal make up of species, varieties, selections and inter-specific hybrids of coffee to help in the coffee breeding programme.

1. Studies on inter-specific hybrids

The following were under study —

(i) S. 594 — F of S. 274, 1/11 Robusta X S. 450, 2/1 Kents arabica

(ii) S. 905 — 1st back-cross with Kents arabica
(S. 594—2 X S. 450, 2/1 Kents arabica)

(iii) S. 908 — 1st back-cross with robusta
(S. 594—2 X S. 274, 1/11 robusta).

The F_1 S. 594, shows 2n = 33 chromosomes. In the 1st back-cross with Kents arabica, S. 905, 21 plants show 2 n = 44 and one each 2 n = 33 and 55. All the 4 plants in the 1st back-cross with robusta, S. 908, show 2 n = 44. Further co-ordinated studies are in progress on the pairing behaviour of the chromosomes during meiosis, morphological characters and fertility.

2. Studies on microsporogenesis in Kents arabica

Kents arabica has 2 n = 44 chromosomes (Ann. Rept. 1954 - 55). Microsporogenesis in S. 450 Kents arabica was under study. It was observed that the 44 chromosomes paired regularly and formed 22 bivalents. Rare instances of multivalent formation were also noticed Upto 16% pollen grains were found to be shrivelled and shrunken. Studies are in progress.

3. Colchicine treatment of robusta seedlings to induce doubling of chromosomes

The two robusta seedlings in which doubling of chromosomes by treatment with Colchicine was reported in the Annual Report for 1955—'56 continued to be under observation. In one of the plants, the doubled chromosome number remained constant. In the second plant adjacen sectors with diploid and tetraploid numbers were observed. Even in the same leaf adjacent parts with diploid and tetraploid cells were formed. In the tetraploid portions, the size of the stomata is bigger and their number per unit area smaller.

F. MISCELLANEOUS CROPS.

1. Green manures and cover crops

24 lb. seeds of green manure and cover crop seeds were made available for planting in experimental plots and for supplies to indentors.

2. Shade trees for coffee

(a) 9 lb. seeds of **Maesopsis eminii** were supplied to (1) planters, (2) Shri Keshavagopal Naidu, Deputy Conservator of Forests, Andamans, and, (3) District Forest Officer, S. Kanara District, Mysore state.

(b) Seeds of **Pterocarpus dalbergioides** (Padauk) were obtained through the courtesy of Shri Keshavagopal Naidu, Dy. Conservator of Forests, Andamans, and seedlings have been raised at the Balehonnur Station

(c) 8 oz. seeds of **Leucaena glauca** were supplied to the Agricultural Research Institutes in Bihar.

(d) Seedlings of (1) **Albizzia maranguensis.** (2) **Albizzia coriaria,** (3) **Entada abyssinica,** (4 **Cordia abyssinica,** (5) **Trema guniensis,** and, (6) **Machaerum tipu** were raised from seeds obtained through the courtesy of the Director of Agriculture, Dept of Agriculture, Kenya. The seedlings have been planted at the Balehonnur Station.

EXPERIMENTS AT THE COFFEE RESEARCH SUB-STATION, CHETHALLI.

Varietal Trial : The varietal trial laid out in 1949 to test the selections S. 795, S 288, S. 645 and S. 446 as described in the earlier reports was continued. The sixth crop from these plots was harvested. The data are given in Appendix XXXI. S. 795 is continuing to give consistent high yields.

R. L. NARASIMHASWAMY,
Botanist.

III. CHEMISTRY

Experiments on the manurial requirements of coffee, land management with special reference to soil and moisture conservation, influence of trace elements on growth and health factors, moisture and temperature on the opening of blossoms, hormones on fruit-set and studies on the processing of coffee formed the main items of work of this Division. The division also attended to routine examination of soils for advisory work and undertook visits to problem areas for investigation and advice on soil and crop husbandry. At the request of the Ministry of Home Affairs, Government of India, a survey on the possibilties of growing coffee in the Andaman Islands was undertaken in collaboration with the Special Officer for Coffee Development, Government of India, Ministry of Commerce & Industry, and, a report submitted to the Government of India.

FIELD EXPERIMENTS

A. Manurial Experiments.

(i) Studies on the essential requirements of plant foods N. P. K for coffee in relation to improvement in Yield (New Manurial Series.)

This experiment described in detail in previous reports was continued. About the end of July 1956, leaf disease made its appearance and consequently defoliation followed by dieback occurred. This happened in spite of two sprays of Bordeaux mixture given in the pre-monsoon period. The incidence of disease was highest in plot No. 1 (Control) and decreased as one proceeded progressively to plot No. 25 (N. P. K.). 75 branches were tagged in each treatment to study whether manurial treatment had any beneficial effect upon the plants with respect to incidence of leaf disease and die-back, and observations recorded. The number of branches that dried in each treatment following leaf disease defoliation and dieback was :

Control = 56; N. P. = 52; N. P. K. = 50; N. = 48 & N. K. = 42.

The yield record of the experiment and the percentage of floats in the harvest are given in Appendix XXXII. As reported earlier, the plant population in the experimental area was halved. Yields have been calculated on the crop produced on 20 plants which exist now in the sub-plots and also calculated for 40 plants for purposes of comparison.

There was a severe attack of leaf disease followed by die-back resulting in a heavy drop in crop. An examination of the data shows that all treatments are significantly superior to control. Treatment B (N. P.) is significantly superior to A (N only) and C (N. K.) but not to D (N. P. K.) and there exists no significant difference between D, A and C.

In the analysis of the average yield of ripe cherry over 17 years, all treatments are seen to be superior to E (Control). Treatment B (N. P.) is significantly superior to A (N. only) and C (N. K.) but not to D (N. P. K.). Treatment D in turn is significantly superior to A (N. Only) but not to C (N. K.). In the ananlysis of the average yield of clean coffee over 9 years, all treatments are significantly superior to E (Control; treatment B N. P.) is superior to treatment A (N. only) and C (N. K but not to D (N. P. K); there exists no significant difference between treatments D, C and A.

In the determination of floats by weight and volume, the treatments have not been significant. As compared with previous years, the percentage of floats has been high. Treatment D (N. P. K) has had the greatest percentage of floats this year whilst treatment B (N. P) had the highest percentage in the previous year.

Grouping the yield of clean coffee in cwt/acre into periods of five years and calculating the yield as percentage of control, the following are obtained :

	N.	NP.	NK.	NPK.	Control.
1949—1953	136.3	129.0	129.0	126.6	100
1950—1954	141.8	129.1	138.0	136.7	100
1951—1955	120.1	129.8	122.0	122.7	100
1952—1956	112.6	130.0	112.8	120.4	100
1953—1957	118.4	146.6	118.3	134.0	100

Calculating the average yield of clean coffee over three year periods when the different manurial formulae viz. 20 N : 30 P_2O_5 : 40 K_2O ; 40 N : 30 P_2O_5 : 40 K_2O ; and 60 N:30 P_2O_5 40 K_2O were operating and calculating it as percentage of control, the following figures are obtained :

	N.	NP.	NK.	NPK.	Control.
$\frac{20\ N_2—30\ P_2O_5—40\ K_2O}{1947—1950}$	95.6	102.2	94.8	98.1	100
$\frac{40\ N_2—30\ P_2O_5—40\ K_2O}{1951—1954}$	144.4	131.0	143.0	149.9	100
$\frac{60\ N—30\ P_2O_5—40\ K_2O}{1954—1957}$	117.8	150.2	117.0	133.1	100

The following trends become evident from the above tables :

1. Yield increases over control have been steady in the case of Treatment N. P.
2. Phosphates seem to help in the better utilization of Nitrogen.
3. Application of nitrogen alone does not seem to produce increases in crop proportionate to the increase of the fertilizers applied.

(ii) Studies on the manurial requirement of coffee in relation to improvement in Yield :

(a) N. P. K. trials with varying levels of N. P. & K. (Fundamental Manurial Experiments in the pH cisterns :

This experiment laid out in 1950 was continued. The yield records of the experiment and the percentage of floats in the harvest are given in Appendix XXXIII.

The treatments are not significant even in an analysis of yields over the four years average.

(b) N. P. K. Trials with varying levels of nitrogen with constant levels of P & K (17-Acre manurial experiments—1952 Series)

This experiment started in 1952 was continued. Though treatments have not been significant, Treatment C (100 N : 30 P_2O_5 : 40 K_2O) gave numerically the highest yield.

RESPONSE TO MANURING

NEW MANURIAL SERIES

COFFEE RESEARCH STATION
BALEHONNUR

YIELD RECORD IN Cwts

A - N, B - NP, C - NK, D - NPK, E - CONTROL (NO MANURE)

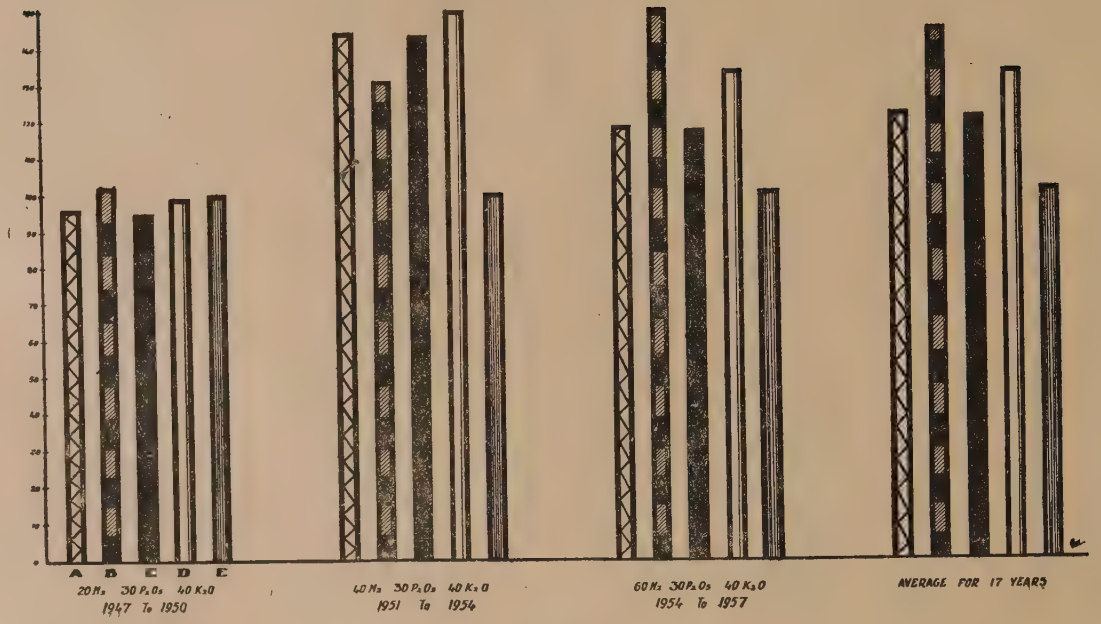

Fig. 5

(c) **N. P. K. trials with constant levels of N. P. K. but varying sources of nitrogen (17-acre manurial experiments - 1953 series).**

This experiment started in 1953 was continued. As stated in the previous report, the blossom on the green wood had been rubbed off and only that on brown wood retained.

(d) **N. P. K. trials with varying levels of P & K and constant level of Nitrogen (17-acre manurial experiment - 1954 series.**

This experiment started in 1954 was continued.

(e) **Comparative trials on the influence of different forms of nitrogen on the growth and yield of coffee (Experiments in Rubber area) :**

This experiment started in 1953 was closed during the year under report. Analysis of four year yield records showed great variation in the particular influence of the different forms of nitrogen. The treatments were again not significant during the current year also and, showed the same trend of varying influences as in the earlier years.

The experiment was therefore remodelled on a more elaborate form and laid out in a neighbouring estate.

(f) **N. P. K trials with varying levels and combinations : Arabica manurial experiment at the Coffee Research sub-station, Chethalli, Coorg.**

This experiment started in 1952 was continued. The, yield record of the experiment is given in Appendix XXXIV.

The yields have been of the order of 17-18 cwt. of clean coffee to an acre and very heavy considering the fact that the plants were only just 5 years from seed. In the statistical analysis, it has been found that treatments have not been significant but that a statistically significant difference exists between blocks possibly due to an inherent difference in nutrient status of the different blocks. Continued cropping under treatments would therefore be necessary before final differences can be recognised.

(g) **Studies on ths effect of aldrinized fertilizers on yield of coffee.**

The two experiments have been described in detail in the Annual report for 1955-56. The yield records of the experiments located at the coffee Research Station, Balehonnur and, the Coffee Research sub-station, Chethalli, are given in Appendix XXXV a & b. The treatments have not been significant. However, it may be noted that Treatment D (80-45-60 fertilizer+ 1 lb. of aldrin) has given numerically the highest yield while treatment B (80-45-60+2. 25 lb. aldrin) with higher dose of aldrin has given the lowest.

(h) **Test scale observational trials on the effect of increasing doses of manure on coffee**

The two trials, one on arabica and the other on robusta, laid out and started in May 1956 were continued. Details of the trials are given in the 9th Annual Report. The yield of 1956-57 was recorded, and forms the basic data.

(iii) **Field trials to find out the maximum economic dose of nitrogen and the role of phosphates in balancing the nitrogen utilization ;**

This trial laid out in May 1956 was continued. Details of the trial are given in the 9th Annual Report. The yield from the plots obtained during the harvest of 1956-57 has been recorded and forms the basic data.

(iv) Field trials on private estates

(a) Studies on the application of nitrogen only in divided doses in relation to yield on coffee :

This experiment laid out in 1953 in one of the private estates (Ossoor Estate, Sakalaspur Mysore State) was continued.

The yield records of the experiment are given in Appendix XXXVI. The treatments have not been significant.

(b) Effect of different sources of nitrogen on the growth and yield of mature yielding coffee

This experiment started in April 1956 in Shegode Estate near the Coffee Research Station, Balehonnur, was continued. The yield from the plots has been recorded and forms the basic data.

(v) Field Manurial Trials on Private Estates-Arabica

The trials started in 1954 on ten private estates situated in different soil climatic zones of the coffee growing tracts of S. India were continued. The yield records of the harvest of 1955 56 and 1956-57 are given in Appendix XXXVII.

The treatments have not been significant. In the analysis in 6 localities, there existed a significant difference between blocks of the experiments in 1955-56, which has decreased to 5 cases in 1956-57. An examination of the data presented would show the following trends :

(1) In the 10 experiments over two years, numerical superiority of treatments having P (i. e. NP or NPK) over other treatments is in 15 cases out of 20.

(2) In no case has N1 (Nitrogen applied in two doses) been numerically superior to other treatments which are all N2 (application of nitrogen in three doses). Thus it would prove profitable to supply nitrogen in split doses in all cases.

(3) In 7 cases each out of 20, treatments D and B are numerically superior to the rest. Treatments C and A have been numerically superior to the rest in 5 cases and in one case respectively. The increase in yield on account of addition of 30 lb. P_2O_5 to the acre along with nitrogen at the level of 40 lb. per acre is 6 cases out of 10., at 60 lb. level 6 out of 10., at 80 lb level 5 out of 10 and at 100 lb. level 5 out of 10.

(4) The increase due to the addition of 40 lb. potash to the acre along with 30 lb. phosphoric acid at the level of 40 lb. nitrogen to the acre is 5/10., at 60 lb. level 6/10., at 80 lb. level 8 10 and at 100 lb. level 5/10. This would indicate that 40 lb. potash to the acre would be sufficient upto 80 lb. level of nitrogen, but beyond that it may be inadequate.

(vi) Manurial experiments on robusta coffee:

RESPONSE TO MANURING.
FIELD MANURIAL EXPERIMENTS IN PRIVATE ESTATES ON ARABICA COFFEE

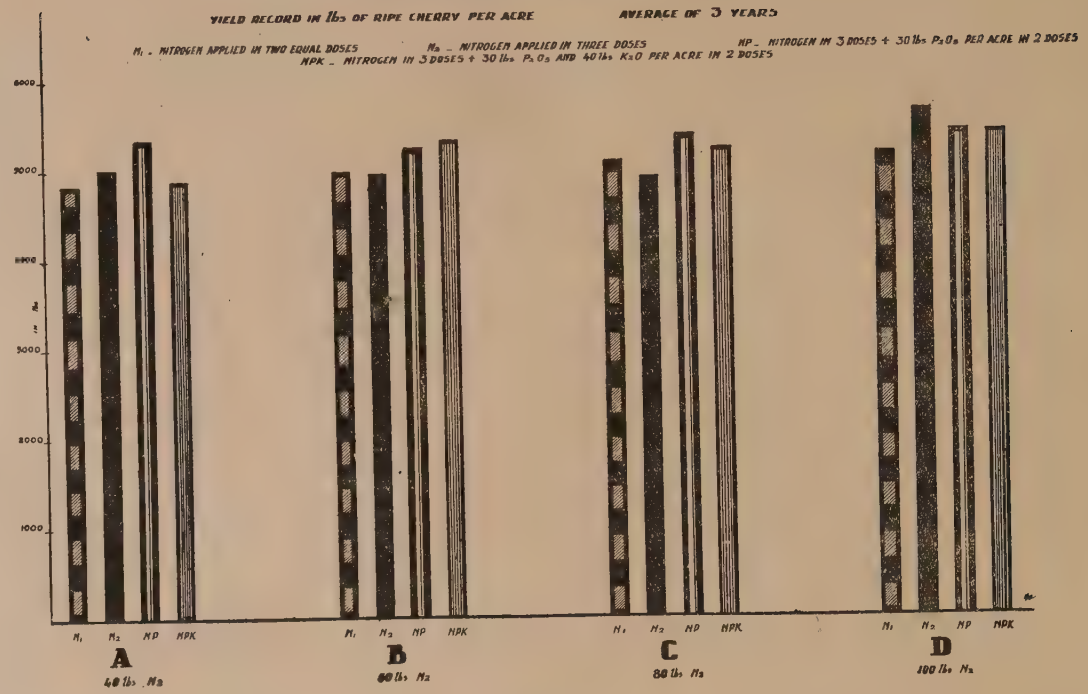
YIELD RECORD IN lbs OF RIPE CHERRY PER ACRE
AVERAGE OF 3 YEARS
N1 - NITROGEN APPLIED IN TWO EQUAL DOSES
N2 - NITROGEN APPLIED IN THREE DOSES
NP - NITROGEN IN 3 DOSES + 30 lbs P2O5 PER ACRE IN 2 DOSES
NPK - NITROGEN IN 3 DOSES + 30 lbs P2O5 AND 40 lbs K2O PER ACRE IN 2 DOSES
6000
5000
4000
3000
2000
1000
N1 N2 NP NPK
A
40 lbs N2
B
60 lbs N2
C
80 lbs N2
D
100 lbs N2

Fig. 6

(a) N. P. K. trials with varying levels & combinations (Coffee Research sub-station, Chethalli, Coorg:)

This trial started in 1954 was continued. The young plants were not allowed to crop.

(b) Field Manurial trials on robusta coffee:

The trials started in 1955 in 5 private estates in Wynaad (Kerala State) and Saklespur (Mysore State were continued). The yield data from the harvest of 1956-57 is presented in Appendix XXXVIII. Statistical analysis of the yield data shows that there exists a significant difference between blocks in the experiments in three cases out of five. The main treatments have not been significant in two cases, viz. North Carolina and Krishna Estates in Kalpetta though the sub-treatments are significant. However the following trends may be noticed:

(1) In two cases each out of five, treatments B & D are numerically superior to the rest and in the fifth case treatment A is superior.

(2) In all the five cases, treatment NPK. is numerically superior to the rest. In North Carolina estate however, treatment NPK. is superior to N2 and N1 but not to N. P.

(3) In three cases out of five, NPK is followed by NP., whilst in the other two cases, it is followed by N2 and N1.

(4) As between the application of nitrogen in two and three doses; increase in yield due to the latter over the former is seen in 2 out of 5 at 40 lb. level., in 3 out of 5 at 60 lb. level., in 2 out of five at 80 lb. and in 3 out of 5 at 100 lb. This would indicate that when nitrogen is applied at more than 40 lb. to an acre, it would prove profitable to do so in more than two doses.

(5) The increase due to the addition of 30 lb. phosphoric acid to the acre along with nitrogen is seen in 2 cases out of 5 at 40 lb level., in 1 case out of 5 at 60 lb. in 3 cases out of 5 at 80 lb. and in 2 out of 5 at 100 lb.

(6) The increase due to the addition of 40 lb. potash to the acre along, with 30 lb phosphoric acid at the level of 40 lb nitrogen to the acre is seen in 4 cases out of 5; at 60 lb level of nitrogen in 4 out of 5 , at 80 lb. nitrogen to the acre in 5 out of 5 cases and at 100 lb. nitrogen to the acre in 4 out of 5 cases. Thus it would appear that with robusta, increases in yields may be obtained with a full manure containing NP & K

(c) Modified field trials on robusta coffee:

(d) N. P. K. trials on robusta:

The field trials started in Malabar-Wynaad, Coorg and Mysore, as detailed in the Annual Report for 1955-56 (9th Annual Report) were continued. The yield from the experimental plots have been recorded and form the basic yield data,

(vii) Exploratory trial on the effect of foliar applications of plant foods to coffee in relation to growth & yield:

The trial was started in May 1956 and details of the trials are given in the 9th Annual Report. The yield records of the experiment and the observations on the development from

blossom to berry are furnished in Appendix XXXIX, (a) and (b). The treatments were not significant. Treatment 1 (Control) has been numerically superior to the rest of the treatments in both yield of cherry, clean coffee and blossom to berry counts.

(viii) **Experiments on the response to manuring of coffee seedlings in the nursery:**

(a) N. P. K. trials with varying levels & combinations:

This experiment started in June 1956 to find out the essential requirements of plant foods N P & K. for good growth of arabica seedlings was continued. The details of the experiment are given in the 9th Annual Report. The increase in height of seedlings, the number of primary branches on seedlings and the number of leaves in seedlings have been recorded and are furnished in Appendix XL, (a), (b) and (c).

1. In the analysis of data with respect to increase in height, Treatment J (NoP_2Ko) is numerically superior to all the treatments and statistically superior to B O R M N C I D T U-W at 1% level and to Y Q K also at 5% level of significance. An examination of the occurrence of treatments, show that out of the sixteen treatments that are to be found prior to treatment B, 9 have No, 6 N1, 1N2, 5 Po, 5 P1, 6 P2, 7 Ko, 5 K1 and 4 K2. Amongst the treatments occurring from B to W mentioned above, 8 have N2, 3 N1, 4 Po, 4 P1, 3 P2, 2 Ko, 4 K1 and 5 K2.

2. In the analysis of data with respect to number of primaries formed, Treatment J (NoP_2Ko) is numerically superior to all Treatments. Main treatments have not been significant even at 5% level.

3. In the analyais of data with respect to the increase in the number of leaves (initially all of them had 6 leaves) treatment J has been numerically superior to the rest At 1% level, treatments have not been significant. At 5% level, treatment J is significantly superior to the rest except Z G V E

4, Limed and unlimed prepared soils made up of two parts of top soil from jungle, one part of compost (made out of coffee fruit skins, urea and rock phosphate) produced more number of leaves, greater number of primaries and increase in height of seedlings and these are significantly superior to limed or unlimed ordinary soil. The limed soils produced better growth than the corresponding unlimed soils.

5. In the analysis of variance of data pertaining to increase in height of seedlings apportioning the effects due to N, P, K, NK, NP, PK and NPK, the effects due to N, K, and PK have been found to be significant; in that of initiation of primaries, N, P and PK have been found to be significant.

The experiment was carried out employing a fairly rich soil; the analysis of the two types of soils used were as follows:

	Organic carbon.	Total Nitrogen.	C/N.	Total K_2O	Total P_2O_5	Available. P_2O_5	K_2O
	%	%		%	%	%	%
Ordinary soil.	2.56	0.180	14.16	0.226	0.076	0.0008	0 0129
Prepared soil.	3.05	0.215	14.47	0,213	0.143	0,0427	0,0252

From the statistical analysis of the data it becomes evident that (1) phosphates have a great influence on the growth of seedlings, (2) for initiation of primaries there should be adequate amount of P & K and (3) even where a rich soil is employed, it would prove profitable to apply P & K.

(b) **Studies to find out the maximum utilizable dose of nitrogen by young coffee seedlings, with and without the addition of phosphorous and potassium:**

This experiment was started in 1957.

Treatments: Main 6. Sub-treatments: 2 in each main treatment.

Main treatments:

No	=	0 lb.	nitrogen to 1200 seedlings in 20 applications.	
N1	=	12 lb.	-do-	-do- -do-
N2	=	24 lb.	-do-	-do- -do-
N3	=	48 lb.	-do-	-do- -do-
N4	=	96 lb.	-do-	-do- -do-
N5	=	192 lb.	-do-	-do- -do-

Sub-treatments:

Each plot receiving a main treatment is split into two halves with one half receiving phosphorous and potassium according to the following scheme -

No	+	Po	0 lb.	P_2O_5	+	Ko	0 lb.	K_2O	to 1200 seedlings in 20 applications.
N1	+	P1	7½ lb.	"	+	K1	12 lb.	"	-do-
N2	+	P2	15 lb.	"	+	K2	24 lb.	"	-do-
N3	+	P3	30 lb.	"	+	K3	48 lb.	"	-do-
N4	+	P4	60 lb.	"	+	K4	96 lb.	"	-do-
N5	+	P5	120 lb.	"	+	K5	192 lb.	"	-do-

Plot size:

Each main treatment has a population of 100 seedlings of approximately the same growth. These have been planted in beds prepared with a well-mixed uniform soil made up of two parts of Jungle soil, one part of cherry husk compost and one part of ordinary soil. Beds formed are 9′ x 2¼′ x 6′ with 1′ wide path between beds. The foot-paths so formed were dug to a depth of 1½′ and packed with rouble stones to serve as drains. Seedlings have been planted 5″ apart in 5 rows of 21 seedlings each, the 11th row forming a border row separating the sub-treatments. The beds have been held in position by bamboo slats and raised slightly above ground level to prevent surface water from adjoining areas flowing in during rains. Ten seedlings are removed from each sub-plot once in two months and measurements taken for length of stems and roots and weight of leaves, stalks and roots are recorded separately. The different parts are to be analysed for N. P. K

Replications: 3. **Layout:** Randomized.

Time and mode of application of treatments:

Nitrogen in the form of Urea, Phosphorous in the form of Hyper-phosphate Reno and Potassium in the form of Muriate of potash are being used to supply the plant foods. The required quantities of fertilizers are applied dispersed/dissolved in water once a fortnight. An equal quantity of water is applied to the control plots.

(ix) **Field trials on the effect of minor elements on the growth and yield of coffee (Experiments with Chelates):**

This experiment was started in July 1957 to study the effect of minor elements on the growth and yield of coffee. The details of the trial are given below:

Treatments: 6 **Replications:** 6. **Layout:** Randomised

Treatments:

A. Sequestrene NaFe @ 12 gms. per plant
B. " NaCu @ 12 gms. "
C. " NaCa @ 12 gms. "
D. Metaquest (E D.T. A,) @ 12 gms "
E. Es-min-el (Essential Mineral elements) @ 12 gms per plant.

} plus 40 lb. N2, 30 lb. P_2O_5 and 40 lb. K_2O mixture to the acre.

F. 40 N2 : 30 P_2O_5 : 40 K_2O mixture only.

Sequestrene compounds have been supplied kindly by Messrs. Geigy (India) Private Ltd., Bombay. Metaquest has been supplied by Messrs. Fisons Pest Control, England and Es-min-el by the Tennesse Valley Corporation, U. S. A,

The 40-30-40 mixture is to be made up of Ruhr complete fertilizer [12: 12: 21], ammonium sulphate and mineral phosphate.

Time of application of fertilizers:

The total quantity for the year will be applied in three equated doses i. e. (a) Pre-blossom (February-March), (b) Post-blossom-Pre-monsoon (May-June) and (c) Post-monsoon (September-October). The first application of fertilizers will commence with the post-monsoon of 1957.

Plot size: Gross – 4 x 4 = 16 plants.
Nett – 2 x 2 = 4 plants.

Guard row: 1. General guard row all round the experimental block.
2. Common border row between adjacent sub-plots.
3. Foot-paths 8′ wide separate the replications.

Observations on (1). General health (visual)
(2). Growth measurements at intervals of 3 months.
(3). Yield of ripe cherry from nett plots will be recorded.

Foliar analysis for N.P.K and minor elements will be carried out from the ninth month after planting at monthly intervals.

B. Cultural Experiments :

(i) Studies on growth and yield of coffee in relation to shade requirement – Hedge row system of planting:

The experiment started in 1953 was continued. A small crop was picked in December 1956 and the yield has been recorded. The blossom that opened in April 1957 was fairly good and a fair crop is expected to be picked in the harvest of 1957. Wet and dry bulb thermometer readings, soil temperature and soil moisture tension were all recorded daily between 8 and 8-30 A. M., 1-30 and 2 P. M, 4-30 and 5 P. M. The data so far recorded is under examination. The general trends stated in the 9th Annual Report continue to hold good during this year also.

(ii) Studies on fruit set of coffee:

Experiments with Duraset were continued. The yield records of the experiments are given in Appendix XLI,(a) and (b). The statistical analysis of the data show that in yield of cherry -

Arabica: (1) treatments have been significant in preblossom application only Treatment G (Plain water) is significantly superior to the rest except F (Duraset 20-W 0.26 lb. i. e 120 gms. in 100 lb. talc. dusted) and I (Control).

(2) treatments have not been significant in the 'on-the-blossom' application. Here again treatment G is found to be superior to the rest.

(3) treatments have not been significant in the application made at petal fall. Here, however, treatment A (Duraset—20 W ½ lb. in 100 gallons of water sprayed) is numerically superior to the rest and is followed by D (Duraset 20 - W 0.13 lb. (60 gms.) in 100 lb talc, dusted) and G (Plain water).

Robusta: (1) treatments have not been significant in preblossom application Treatment E (Duraset 20 - W 0.26 lb. (120 gms) in 100 lb. talc dusted, is numerically superior to the rest.

(2) treatments have not been significant in the 'on the blossom' application. Treatment G (plain water) is numerically superior to the rest.

(3) treatments have not been significant in the application made at petal fall. Treatment A (Duraset 20 - W ½ lb. in 100 gallons of water sprayed) is numerically superior to the rest and is followed by treatment G (plain water) and D (Duraset 20 - W 0.13 lb. (60 gms.) in 100 lb. talc, dusted).

Blossom to berry counts did not give any significant results.

The experiment was repeated in the blossom of 1957 also and observations are being recorded.

LABORATORY.

Work in the laboratory consisted mainly of analysis of soil and plant samples sent by planters and those collected by the division. Seventy one samples of soil from the different blocks of the Coffee Research Station, Balehonnur were collected and tested for available plant nutrients and pH. These were classified by comparison with Munsell Colour Chart. The mechanical analysis for texture was also carried out. A soil map of the Station was prepared based on the data.

(a) Analysis of soil samples from the Coffee Research Station, Balehonnur:

The soils vary in colour from brown through reddish brown to dark brown. The major portion of the Station is sandy loam (54%), a smaller part is loamy (39%) and the remaining portion is clayey loam in texture. They are slightly acid in reaction. (pH 5.6-6.6.) They are all well supplied with active potash (K 10 parts to 50 parts per million). However they are extremely deficient in active phosphoric acid (blank to less than ½ ppm).

(b) Analysis of soil samples from the arabica manurial experiments - 17 acre 1953 series (N. P. K. trials with constant levels of N. P. K but varying sources of nitrogen :)

Fifty samples from the 25 plots in the above experiment were collected from the 0-9″ and 9″-18″ layers before the application of treatments in May 1954 and analysed in order to assess the initial fertility status of the plots. The whole area is a sandy loam The openness of the soil indicated by a higher coarse fraction/fine fraction ratio increases from the first row of plots to the fifth row. The ratio is fairly uniform in the columns The plot is fairly uniform with respect to total P_2O_5 and total K_2O. pH varies within very narrow limits (6.2 to 6.8).

(c) Seasonal variations in available phosphates and potash in coffee soils under different shade trees:

The study started in May 1956 to find out seasonal variations in the availability of phosphates and potash and exchangeable bases in coffee soils under six shade trees commonly grown in coffee plantations has been carried out over the programmed 13-month period. Determinations from the 12th and 13th month are yet to be completed. An assessment of the data collected will be undertaken when the analysis is completed.

(d) Studies on the uptake of plant nutrients and seasonal variations

The study started in 1956 January, on the seasonal variation in up-take of plant nutrients under differentially treated condition was continued.

Wide variation was noticed in the nutrients in the soil during different seasons of the year. The variation was more pronounced in the case of nitrates The nitrate level was low during the period May to September varying from traces to 15 ppm in the soil extract. Higher values for nitrate (150 ppm) following the post-monsoon manuring, was maintained during November, but gradually dwindled during the succeding months until it reached a value of 40 ppm in February. The values were found to be high during March and April

Active P was found to be in traces or less than ½ ppm in the soil extract in the P treated plots during the two months immediately following the application of fertilizers. During the rest of the period active P as revealed by the tests was either blank or in traces.

The level of active K in the soil did not show much variation except during the months immediately following the application of fertilizers when it was high. At other parts of the year, the values remained within 5-20 ppm in all the plots.

Active Ca was found only in traces during the months October to February

Tissue tests indicated that the nutrients, nitrates and potash were low in the tissues during the monsoon months from May to August. During the actively growing period September, November and April to May, nitrate was medium while potash was medium or low. During the other months, tissues tested high in both nitrate and potash.

(e) **Analysis of soil samples collected in the Andaman Islands:**

Fifty two samples of soils representing the areas surveyed in the North, Middle and South Andamans and Rutland Island were tested on the spot for pH, Nitrate, Ammonia, active P_2O_5, and active K_2O and examined later in the laboratory for total P_2O_5, total K_2O, total nitrogen and organic carbon. Mechanical analysis of these was also carried out The colour of the soils was classified by comparison with the Munsell Colour charts. The analytical data is presented in Appendix XLII.

The soils vary in colour from pale yellow to dark brown. Gradations met with are light yellowish brown, pale brown, reddish brown and dark grey They vary in texture from almost clays to sandy loams. They are mostly acid, pH ranging from 4.5 to 6 except in Interview Island where it is neutral. They are fairly supplied with nitrates (5 to 25 ppm and ammoniacal nitrogen (2 to 25 ppm but mostly ranging round 10 ppm). Active P_2O_5 ranges from blank to 2 ppm whilst active K_2O is from blank to 15 ppm. Organic carbon varies from 0.73% to 5.54% total nitrogen from 0.081 to 0.442%; C N ratio varies from 5.05 to 31.53. Total P_2O_5 ranges from 0.06% to 0.36% whilst total K_2O varies from 0.112 to 0.717%. Total exchangeable bases range from 0.62 to 68.5. me/100 soil gms. The latter figure is from Interview Island soil which is highly calcareous.

(f) **Studies on the foliar feeding of plant nutrients:**

The leaf samples which were collected before and after treatment to study the extent of uptake of nitrogen through leaf surface in May 1956 were analysed for total nitrogen. The analytical data are presented in Appendix XLIII.

An examination of the data shows that difference due to treatments are reflected better in the branch tips than either in the midribs of leaves or leaf laminae. It is also interesting to observe that the branch tips have a higher concentration of nitrogen than mid-ribs.

Leaf samples were collected once again in May 1957 before application of treatments, 24 hours, 48 hours and 96 hours after application of treatments from the foliar feeding trial plots. Both old and young leaves were collected at random. The total nitrogen content of the leaves is given in Appendix XLIV. The determinations of P & K in the leaves are under way.

An examination of the data shows that there is, in general, an increase in the total nitrogen content of the young leaves collected 24 hours after application of treatments and that this falls off in the sample collected after 48 hours. There is no regular increase pattern in the case of older leaves. A statistical analysis of the data with respect to the uptake by the young leaves shows that treatments and blocks have been significant at 5% level. Treatment A (20 lb. nitrogen per acre as urea solution sprayed) is significantly superior to all other treatments except I (control) and C (N_1P_1 i. e. treatment A + 15 lb. P_2O_5 as superphosphate). Treatment B (40 lb. nitrogen per acre as urea solution sprayed) is next in order. Thus it would appear that a dilute solution of urea is better accepted than a more concentrated solution.

(g) **Studies on the losses of nitrogen in mixtures of Ammonium sulphate, Rock phosphate and Hyperphosphate in storage:**

To study the loss of nitrogen that may occur on storage in mixtures of Ammonium sulphate and mineral phosphates, mixtures of these in 1:1, 2:1, 3:1 and 4:1 ratios were prepared and kept in open storage. Samples of mixtures were drawn at weekly intervals and the moisture and total nitrogen determined. The results are presented in Appendix XLV.

It will be seen that highest loss of nitrogen takes place when the mixture is made up of equal proportions of Ammonium sulphate and mineral phosphates, and that loss is reduced as the proportion of phosphate is reduced. Loss of nitrogen is greater in mixtures of ammonium sulphate and hyperphosphate than in those of Ammonium sulphate and rock phosphate

(h) **Studies on the development of spike and blossom in coffee:**

Following an exploratory study carried out in February 1956, a fresh trial was started in February 1957 to study the effect of application of water on the development of spikes to blossom in coffee, and the effect of temperature and humidity on the process.

Treatments: 4. Replications: 4.

Layout : Randomized. Size of plot: Single plant.

Plant material: 1. Leaf disease susceptible variety (Kents)
2. Leaf disease resistant variety (S.288)

Location: Rubber area and 17-acre 1952 clearing at the Coffee Research Station, Balehonnur.

Age of plants: 5 years.

Details of treatments:

O - Control - no treatment.

I - Spraying water (12 gallons per plant each day on two successive days to approximate one inch of rain) on the crown only, leading the drip water away to prevent it from soaking into the soil at the base of the plant.

II - Spraying the same quantity of water on the crown as in Treatment I, and allowing the drip water to soak into the soil at the base.

III - Applying the same quantity of water directly to the soil at the base of the plant.

The treatments were applied on 19-2-1956. The following observations were recorded.

1. Humidity near the plants under each treatment at 8.30 A.M. and also at 4.00 P.M on each day, using Assman's Psychrometer.
2. Temperature and moisture of the soil at the base of the plants under the different treatments at 8.30 A.M. and also at 4.00 P.M.
3. Spikes to blossom counts on two tagged branches of each plant.
4. Weight of samples of buds from the day of application of treatment to the day of blossoms.
5. Moisture content of the buds during the period of study.
6. Tissue tests for nitrate and potash on the petioles.

The data are presented in Appendix XLVI.

It is seen from the data that in plants under treatment II and III buds advanced to blossoms on the 9th day after application of treatments. The average percentage of the original number of buds moved to blossom on selection plants under treatment III was 92.11 while it was 80.71 in the case of Kents. Treatment II had 67.88% buds to blossoms in selections and 40.87% in Kents. In selections under treatment I buds advanced but " paddied " and later dropped, only stray buds reaching the blossom stage in Kents better development was noticed and 12.67% of the buds came out as blossoms. No change was discernible in the buds of control plants. It was observed that " mature " buds only developed to blossoms and the tender buds at the apex and at the lower portion of the branches did not move in any of the treatments.

Data in Appendix XLVI (a) shows that there was a steady increase in the moisture content of the buds as they developed. The initial moisture in buds was between 58 and 60% while at the blossom stage it was 86% resulting in an increase of 43%.

The percentage increase in weight of the buds as they reached the flower stage was 889.14 in the case of slections while it was 584.99 in the case of Kents. It is seen from Appendix XLVI (b) that in the case of selection plants the initial weight of 20 buds was a uniform value of 0.23 gms. in all the treatments whilst it varied from 19 to 0.26 gms. in Kents.

There was no change in the nitrate and potassium status in the petioles during the period of study as revealed by tissue tests. Analysis of buds collected during the 9 days of study for N, P and K are in progress.

There was no comparative difference in humidity either in the morning or in the evening. Evening temperature of the soil near plants under treatments II and III was lower than that near plants under the other treatments, there being no difference in the morning temperature. Moisture of the soil near plants under treatments II and III was between 15 and 20% while it was between 4 and 11% in the soils near the other plants.

To study the effect of different temperature conditions on the development of spikes, branches with mature spikes were kept immersed in water for 5 minutes at different temperatures

of 5°C, 21°C and 35°C. It was seen that spikes dipped in water at 5°C developed half way but did not reach the blossom stage. There was no perceptible change in buds exposed to 21°C. Buds dipped in warm water turned yellow and dropped off later. Partial development was seen on buds exposed to an atmosphere of 15°C by encasing the branch in a double walled alkathene sheet filled with ice water in between the walls.

(i) **Flow of water from the sub-soil drains of the New Manurial Series plots (Analysis of leachates):**

During the season 1956—57 the sub-soil drains of the New Manurial Series plots discharged a total of 1,61,902 gallons of water during the period 3—8—1956 to 17—8—1956. The flow of water through the drains started when total rainfall reached 80.32 inches. In 1954—55 season drains discharged water when the total rainfall received was 81.83 inches (vide Annual Report for 1954—55 Table C. VIII). Leachates were collected from the five drains and analysed for N, P and K. The total quantity of nutrients lost during the season amounted to 3449.10 gms of nitrogen, 4.24 gms phosphoric acid and 4796.73 gms. of potash.

This year also the loss due to leaching was least with respect to phosphoric acid. The data are presented in Appendix XLVII.

(j) **Processing of coffee:**

Exploratory studies to eliminate the fruity flavour of cherry coffee by washing of fruits before drying, washing the beans in cold and hot water, alkali, acid, permanganate and bisulphite tried last year were repeated. Samples of coffee were despatched to Mr. C.R. Devonshire Cup taster in the Liquoring Department of the Coffee Board of Kenya and to New York. The report of Mr. Devonshire has been received. From a study of the report, it becomes evident that none of the processes adopted can eliminate the fruity flavour.

(k) **Studies on the elimination of "fruity flavour" of coffee by storage.**

14 Samples of coffee received from Curing Works situated in the West Coast and in the interior during September November 1956, were tested. They were then stored in glass stoppered bottles aud cuptested in February 1957. It was found that the storing in bottles had mellowed the coffee and a great portion of the "fruity flavour" had been eliminated.

Under instruction from the Research Committee, samples of coffee as under are being received at this Station for cuptasting at three-monthly intervals to find out whether storage in bulk eliminates fruity flavour.

(1) Good whole crop cherry (picked as for parchment)
(2) Cherry prepared from green fruit.
(3) Cherry prepared from over-fermented coffee (small holders' strippings)
(4) Cherry prepared from strippings after parchment has been made.

Coffee in bulk representative of the four types have been stored in Curing Works on the West Coast and inland. Samples are drawn at three monthly periods and sent to the Central Food Technological Research Institute Mysore and the Coffee Research Station, Balehonnur. The samples so received are being cup-tested here for "fruity" flavour. 25 samples of coffee representing the first lot have been tested. These have been stored to form reference samples for comparison with the future lots to be received.

ADVISORY

83 soil samples from Mysore, 32 from Coorg and 17 from Madras were analysed. 2 samples of copper sulphate and one sample of calcium cyanamide were also analysed.

The number of determinations carried out during the year was :

1.	Moisture	... 884.	12.	Total exchangeable bases	... 179.
2.	Loss on ignition	... 215.	13.	Available P_2O_5	... 100.
3.	pH.	... 570.	14.	Available K_2O	... 82.
4.	Organic carbon	... 305.	15.	Insolubles	... 125
5.	Total Nitrogen	... 681.	16.	Mechanical analysis	... 624.
				Total	... 4369.
6.	Water soluble nitrogen.	... 240.		Soil tests	... 7084.
7.	Nitrate nitrogen	... 48.		Tissue tests	... 1192.
8.	Total P_2O_5	... 82.		Soil colour classification	... 123.
9.	Total K_2O	... 107.			
10.	Total R_2O_3	... 50.		Coffee cup testing	... 58.
11.	Total CaO	... 77.		Grand Total	...12826.

GENERAL.

Survey of possibilities of growing coffee in the Andaman and Nicobar Islands:

Along with Shri S. Sundaram, Officer on Special duty Development of Coffee Industry, Government of India, I carried out the survey of the Andaman Islands for selecting spots fit for cultivation. A report on the survey has been submitted to the Government of India. An area of approximately 15,000 acres of the land in the North, Middle and South Andamans and Rutland Islands has been adjudged to be fit for coffee cultivation. Arabica variety of coffee has been recommended to be grown on the upper reaches of the slopes of hills and robusta below that.

EXPERIMENTS AT THE COFFEE RESEARCH SUB-STATION, Chethalli (Coorg)

1. N. P. K. trials with varying levels and combinations - arabica - The experiment is described under Field Experiments para (ii) (f).
2. Field manurial trials on arabica -
   This experiment is one among ten described under Field Experiments para (v)
3. Studies on the effect of Aldrinised fertilizers on yield of coffee-described under Field Experiments para (g).
4. N. P. K. trials with varying levels and combinations-robusta-This experiment has been described under Field Experiments para (vi) (a).

5. Exploratory test scale trial on arabica on the application of varying doses of nitrogen with constant levels of phosphate and potash started in 1954 was continued. The highest yield 7244 lb cherry per acre was harvested in plot that received 60 lb. nitrogen and was followed by 6438 lb./acre in plot receiving 100 lb. nitrogen

6. The manurial demonstration plot laid out in Robusta to demonstrate the effects of manuring with nitrogen alone and in combination with phosphate or/and potash was continued. The highest yield of 3845 lb. ripe cherry per acre was given by treatment NK (60 lb.N + 60 lb K_2O) while treatment NP (60 lb. N+30 lb. P_2O_5), Control, NPK (60 lb. N+30 lb. P_2O_5+40 lb. K_2O) and N (60 lb. N) gave 3370, 3305, 2680, and 2610 lb. to the acre respectively.

N. G. CHOKKANNA,
Chemist.

IV. ENTOMOLOGY.

Studies on the incidence, seasonal intensity and possibilties of an effective economic control of the common pests of coffea viz. Coffee Stem Borer (**Xylotrechus quadripes** Chev), Green bug (**Lecanium viride** Gr.), Shot-hole borer (**Xyleborus morstatii** Hgdn.) and Nematodes parasitic on coffee, were continued.

Experiments laid out during the previous years, for studying the comparative efficacy of different formulations of chlorinated hydrocarbons and organophosphorus compounds against the above referred pests, were concluded, continued or modified during the year based on the results obtained so far.

Several newer insecticides were included in the modified trials laid out in different coffee growing tracts of S. India. Possibilities of controlling Shot-hole borer on *robusta* and Green bug on *arabica* by the use of systemic poisons, have been investigated at greater detail. Some of the recently developed nematicides which have shown promise against certain nematodes, affecting other crops elsewhere, have been obtained through the kind cooperation of the manufacturers for test purposes against eelworms affecting coffee in S.India. Experiments with these products have been started in eelworm infested patches in Coorg and Mysore.

Studies on the residual toxicity of insecticides that are under trial against Coffee Stem Borer could not be pursued further due to the paucity of adult borer beetles for test purposes at the main Research Station.

Collection of various insects found associated with coffee and shade plants, either directly or indirectly, formed the routine work of the Division. This includes, among others, some parasites and predators of both major and minor pests of coffee, reported for the first time in this country.

A. Field Trials on Chemical Control of Pests on Coffee

I. Coffee Stem Borer (Xylotrechus quadripes Chev.)

Of the different trials started during the years 1953 and 1954 to study the relative efficacy of different chlorinated hydrocarbons and organophosphorus insecticides in controlling the pest, three experiments were continued. The insecticides were swabbed on the main stem and thick primaries during the two borer flight periods corresponding to April-May and October-December. Borer incidence in the different plots was recorded by taking counts of healthy and borer affected bushes at monthly intervals. Results are furnished separately under each experiment.

EXPERIMENT 1. Relative efficacy of B.H.C. and its formulations, combination of B.H.C. and D.D.T. and Folidol E.605.

This experiment started in 1953 was continued and the data recorded during the current year as well as from the start of the experiment are furnished in Appendix XLVIII.

It is observed that during the year under report B.H.C. 50% W.P., Isexit W.P., and Folidol E-605 W. P. were effective in controlling the pest Observations from the start of the

trial indicate that B.H.C. formulations - W.P. and emulsion - have consistently effected good control of the pest as compared to the rest. B.H.C. dust and Folidol emulsion did not show much promise.

There has been a general decrease in borer incidence in most of the treatments and the difference in the degree of borer infestation in between the different treatments appeared rather low. This may perhaps be attributed to the low incidence of the pest in the general estate, which would have otherwise served as a source of infestation in the experimental plots. Continued application of B.H.C. to the entire estate and deligent borer tracing operations which are in progress for the last 8 or 9 seasons, have contributed largely to the reduction in the pest incidence.

EXPERIMENT II. Trials with B.H.C. Dieldrin and Aldrin.

In this experiment, three applications of B.H.C. 50% W.P. at 1% strength are compared with 2 applications of Dieldrex '18' emulsion at 0.5% and Aldrex '24' emulsion at 0.5%. However, no conclusions could be drawn during this year since borer incidence was not observed in any plot including untreated plots. The experiment was started in 1954 and previous years' results indicated the superiority of Dieldrex 0.5% with 2 applications and B.H.C. 1% with 3 applications a year over Aldrex and control in their effectiveness against the pest.

The above two experiments at the main Research Station, Balehonnur are discontinued.

EXPERIMENT III.

Comparative trials with B.H.C., Chlordane and Dieldrin formulations at varying concentrations.

The experiment was started in a neighbouring estate during 1955 Different formulations and concentrations of Dieldrin (2 and 3 applications per year) were compared with B.H.C. and Chlordane applied thrice a year. Observations recorded are furnished in Appendix XLIX.

The data indicate that 'Dieldrex' emulsion concentrate at 0.25% strength applied thrice a year effects maximum control of the pest. Dieldrex at 0 25%, 2 applications a year and Dieldrex at 0.125%, 3 applications a year, and Dieldrin 50% W.P. at 0.25% applied twice and thrice are next in order. The rest of the treatments, though better than Control appear to be less efficacious as compared to the above.

The experiment is being continued to permit conclusions to be drawn and defined.

EXPERIMENT IV.

Efficacy of Chlordane, B.H.C., and Dieldrin formulations.

Trial with Chlordane at 0.01%, B.H C at 1%, Dieldrix '18' emulsion concentrate at 0.125% and Dieldrin 50% W.P. at 0.25% started at the Coffee Research sub-station, Chethalli during 1955 for the control of Coffee Stem Borer was continued. Results of one year have not rendered any definite conclusions to be drawn regarding the efficacy of the products tested against the pest.

EXPERIMENT V

Trails with Heptachlor and Gusathion.

(a) Two insecticidal formulations - Heptachlor (a chlorinated hydrocarbon) and Gusathion (organophosphorus compound) - recently introduced into the market and claimed to be highly effective against certain species of insects, are being tested to find out their efficacy against Coffee Stem Borer. Trials with these products have been started during 1956—57 in the different coffee zones of Mysore, Madras and Coorg with the active co-operation of the Liaison staff and planters. Details of these field trials are given below.

Treatments : 6

A. Control
B. B. H. C. 50% W. P. at 1% — 2 applications a year
C. do do — 3 applications a year
D. Dieldrin 50% W. P. at 0.125% — 2 applications a year
E. Gusathion emulsion 0.1% — 2 applications a year
F. Heptachlor 25% W. P. at 0.1% — 2 applications a year

Replications : Four

Layout : Randomized

Locality :

Zone	Name of estate	Started in
I. Chikmagalur	Thogarihankal	October 1956
II. Mudigere	1. Chandrapore 2. Bettadamane 3. Baskal	May 1956
III. Saklaspur	1. Cheekapahalli 2. Sirugur 3. Annamahal	October 1956
IV. North Coorg	Madegode	May 1956
V. South Coorg	1. Balemane 2. Ponnathamotte	November 1956
VI. Nilgiris	Glenburn	May 1956
VII. Kalpetta (Wynaad)	Rockwood	May 1956
VIII. Yercaud (Shevaroys)	1. Maryland 2. Arcadia 3. Belvidere	October 1956

(b) In addition to the above, another experiment using Shell sticker along with the four products B. H. C., Dieldrin, Heptachlor and Gusathion — was started in Mudigere zone (Kelagur estate) to find out whether addition of the sticker increases the efficacy of the products by increasing the duration of their toxicity.

Since the above trials have been started only last year, no comparable data are yet available.

II. GREEN BUG (Lecanium viride Gr. Syn. Coccus viridis Gr.)

EXPERIMENT I

Trails with systemic insecticides.

Metasystox and Ekatin — both systemic organophosphorus compounds — were put to test in Chikmagalur, Nilgiris and Yercaud zones. The insecticides were applied to the plants by adopting "Banding technique" where absorbant cotton, a piece 3-4" wide, was wound round the main stem of the plant and enclosed in an alkathene cone fastened to the stem at the bottom of the cone. Into this, known quantities of the insecticidal solution were poured and the top of the cone was closed by tying it firmly to the stem. Thereby, the concentrated solution was kept in constant contact with the surface of the enclosed portion of the stem through which absorption of the insecticide was believed to take place. After a fortnight when the cotton inside was fairly dry the band was removed. Population of the Green bug before and after the treatments at periodic intervals was noted.

In the preliminary trials, with one of the products — Metasystox— 60 to 90% mortality of the bugs was observed when 20 to 30 ml. of 1 and 1.5% concentration of the actual ingredient was applied to 2 to 3 year old *arabica* plants. In the extended trials with the same product and also with Ekatin, on different age group of plants above ten years, the results were, however, not promising. This failure may perhaps be attributed to the concentration and dosage used which may be inadequate to bring about the lethal effects to the same degree, as above, on grown up bushes. Presence of entomogenous fungi on the Green bug also interfered in the proper assessment of the efficacy of the insecticides. The trials are to be taken up further next year.

EXPERIMENT II

Spray trials with organic pesticides.

A trial with some of the newer organic pesticides, like Basudin, Isochlorothion, Malathion as compared with Folidol, to test their relative efficacy against Green bug by directly spraying the diluted solution was taken up during the year. Unfortunately, incidence of entomogenous fungi on green bug was very high in the experimental plants and as such evaluation of the effectiveness of the products tested could not be made. The trials are proposed to be repeated during the coming year.

III. SHOT-HOLE BORER (Xyleborus morstatti Hgdn.)

EXPERIMENT I.

Spray trials with chlorinated hydrocarbons.

Comparative efficacy of the organic pesticides—B.H.C. Dieldrin and Heptachlor—against the pest was tested by spraying the diluted insecticides to *robusta* bushes. Counts of infested twigs before treatments and thereafter, at periodic, intervals did not bring about appreiable reduction in the pest incidence on treated plants as compared to those untreated (control).

EXPERIMENT II.

Trials with systemic insecticides.

Studies on the use of systemic insecticides, Systox, Metasystox and Ekatin, were conducted on 2-year old *robusta* plants raised in pots and also on 20 to 25 year old grown up bushes in the field. "Banding technique" as described earlier, was adopted for application of the different insecticides.

(a) Green twigs of young potted *robusta* plants were kept under muslin cloth enclosures, and a large number of adult beetles were released within at periodic intervals. These twigs were removed after five weeks and examined for the evidences of successful infestation by the pest.

Several series of the trials with Systox, Metasystox and Ekatin at 1.0%, 1.5% and 2% concentrations were run during the months when the pest was active. Very conflicting results havebeen obtained during this preliminary study. Sometimes, attempts to infest the twigs artificially were met with failures both on the treated as well as untreated plants. Further attempts are in progress to evaluate the efficicacy of these products against the pest.

(b) Trials on mature plants were conducted with Metasystox and Ekatin with 1.5% and 3.0% active concentrations. Shot-hole borer incidence due to natural infestatation was recorded prior to the application of the treatments and at monthly intervals for 4 to 5 months. Data recorded in both the series of trials have not shown any appreciable difference between treated and non-treated plants with regard to short hole borer incidence. The trials are being repeated with some modifications in the technique.

III. STUDIES ON THE CONTROL OF SOIL PESTS:

(a) Nematodes.

The awareness to the increasing importance that the eelworms are assuming in certain localised coffee patches of Mysore and Coorg has lead to a more intensive search for a suitable material that can keep the ravages of the pest under check or completely eradicate it if possible. Use of soil ameliorants with and without sulphur was investigated. Newer nematicides which are reported to have shown promise against eelworms on other crops elsewhere have been obtained during the year for testing against the parasitic eelworms associated with coffee. V.C-13 nemacide, Crog fungicide, Nemagon and Vapam have been obtained through the kind co-operation of their manufacturers and preliminary trials have been started. Details are furnished separately.

EXPERIMENT 1.

Trials with soil ameliorants with & without sulphur.

Treatments: 3

A. Control - normal dose manure N. P. K. 60. 30. 40. applied in two doses.

B. Soil amendment - 1. Pre-blossom calcium cyanamide at 20 lb. N to an acre.

2. Pre-monsoon-post blossom Sulphur at 1 cwt to an acre.

3. Post-monsoon Urea at 80 lb. N to an acre.

C. All treatments as in B except sulphur.

Note: In treatments B & C, Phosphate & Potash are applied at 45 lb & 60 lb. to the acre respectively.

Replications: 6. **Layout: Randomized.**

Plot size: 9 Plants. **Locality: Coovercooly estate, N. Coorg**

Analysis of soil samples from each plot was done at periodic intervals for estimating the eelworm population in each sample. Data are presented in the graph.

Observations regarding the efficacy of the treatments made during the past two years indicate that the treatment, combining soil ameliorants with sulphur keeps the population of eelworm at a low level as compared to other treatments Continued application of the same has not yielded any further reduction of the pest. It is also seen from the graph that there is a trend for reduction in the population of eelworm, irrespective of the treatments.

EXPERIMENT II.

Another experiment with some modifications over Experiment I was started in Yemmigundi estate in South Coorg during November 1956. Details are as follows:

Treatments : 4.

A. Control - normal dose of manure - 60-30-40 applied in two doses.

B. Soil amendment-1. Calcium cyanamide - pre-blossom 20 lb. N to the acre.

2. Urea- 40 lb. N to the acre post monsoon.

3. Wettable sulphur-1 lb. in 50 gallons @ 400 gallons to an acre, applied once in May and again in Oct.

4. P & K applied @ 30:40 to the acre in two doses.

C. Normal dose of manure-60: 30: 40 + Wettable sulphur 1 lb in 50 gallons @ 400 gallons to the acre - once in May and again in Oct.

D. Normal dose of manure - 60:30:40 + 1 cwt. of sulphur of the acre during post-monsoon - application to be forked in at 6″ depth.

Replications : 5 **Layout: Randomized.**

Plot size: 9 plants

Periodic soil samples at 0-36″ depth are being taken from each plot for analysis of eelworm population. The Experiment is in progress.

EXPERIMENT III.

Trials with V.C. 13 Nemacide.

The experiment was started in November 1956 at Coovercolly estae in an eelworm infested patch. 40 plants with ten replicated plots of 4 plants each were taken for the nematicidal treatment and similar number of plots as check for comparison.

One gallon of the diluted solution (1 lb. of V.C. 13 in 50 gallons water) was applied in the drip circle area of 2 ft. radius around each plant. Soil samples are being examined

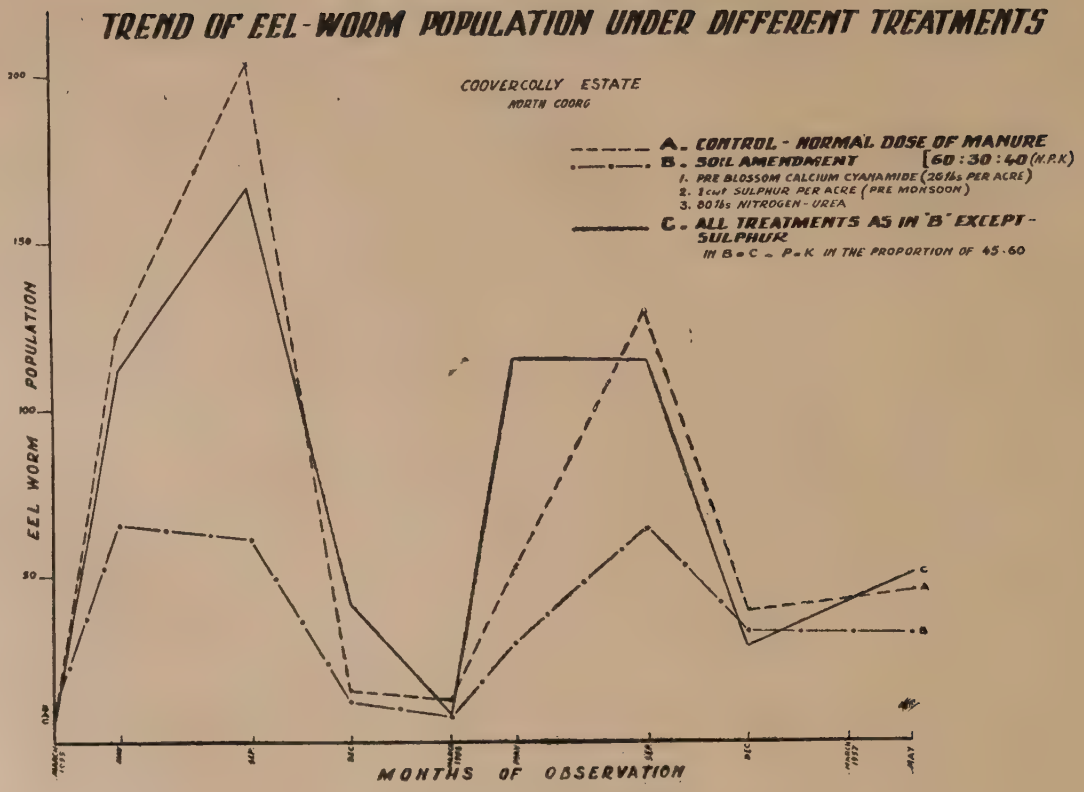
TREND OF EEL-WORM POPULATION UNDER DIFFERENT TREATMENTS
COOVERCOLLY ESTATE
NORTH COORG
A. CONTROL - NORMAL DOSE OF MANURE
B. SOIL AMENDMENT (60 : 30 : 40 (N.P.K)
1. PRE BLOSSOM CALCIUM CYANAMIDE (2 1/2 lbs PER ACRE)
2. 1 cwt SULPHUR PER ACRE (PRE MONSOON)
3. 80 lbs NITROGEN - UREA
C. ALL TREATMENTS AS IN 'B' EXCEPT - SULPHUR
IN B & C - P & K IN THE PROPORTION OF 45 : 60
EEL WORM POPULATION
200
150
100
50
0
C
A
B
MAY
MONTHS OF OBSERVATION

Fig. 8

for eelworm population at periodic intervals before and after treatments. The observations are proposed to be coninued for a period of 2 years from the start of the experiment.

EXPERIMENT IV.

Trials with Crag fungicide.

Two concentrations of this product at 5 ppm and 7.5 ppm are under test on young plants raised in pots. 80 pots for each treatment including control were filled with soil infested by eelworm and young *arabica* seedlings were planted in each of them. The trials were started in December 1956 at Coovercolly estate and soil samples from each pot root-scrapings from 4 seedlings pulled out from each treatment are being examined every month for the estimation of eelworm population. Observations so far made neither show perceptible reduction in the population of eelworms nor is there any difference in the growth of seedlings between treated and untreated ones. The observations are to be continued for a period of 13 months from the start of the trial.

EXPERIMENT V

Trials with Nemagon

These trials are laid out in Ossoor and Belagode estates in Saklespur zone, where eelworm appears to be responsible for the difficulty in establishing the *arabica* plants successfully in certain patches.

Plants ranging from 3—4 years of age were selected in the patch and diluted solution of Nemagon (1 in 2000) was applied to a drip circle area of 2 ft. radius after preparing a shallow basin to retain the liquid and porcolate in that area. After metering 8 gallons of the diluted solution and allowing it to soak for some time, the surface was covered with loose earth. Twenty plants were taken in each estate for this treatment with another 20 plants as control to which mere water was applied at the base. Soil samples were taken prior to treatments and again 2 months thereafter, for taking population counts of eelworm. This is to be followed up by periodic sampling and estimation of the pest population for a period of 2 years.

Another nematicide, " Vapam ", has just been received and trials are to be taken up during the next year.

(b) **Use of Aldrinized fertilizer mixture for the control of soil pests :**

This experiment which was started in 1955 to find out the utility of Aldrinized fertilizer mixture in coffee plantation, was continued. Two years observations on the effect of the insecticide-manure mixture on soil insects have not given any conclusive data so far. Chiefly, the soil fauna in the experimental plots comprised of earthworms and negligible numbers of centipedes, millipedes and cockchafer grubs as observed in samples dug out in 1 ft. square area at random upto 9″ deep. The population of the different insects in the soil varied from time to time depending, perhaps, on temperature, moisture content etc. of the soil. It was observed that these were present in the upper layers of soil when the latter were fairly moist and moved down as the top layers became dry during the dry months. Since the number of harmful soil insects associated with coffee was too negligible in the experimental plots, proper evaluation of the effects of the insecticide manure mixture was not possible.

B. LABORATORY STUDIES.

1. Studies on insect parasites of Green bug.

Certain hymenopterous parasites were observed to be active duting the months, March to May, at the main Research Station. These were collected and were later got identified through the Commonwealth Institute of Entomology, London as follows :

1. **Coccophagus bogoriensis Kon.**	**Fam. Aphelinidae**
2. **Coccophagus sp.**	**Order. Hym.**
3. **Marietta javensis How.**	
4. **Microterys flavus How.**	**Fam. Encyrtidae**
5. **? Gen. nr. Microterys**	**Order. Hym.**

The first three parasites mentioned above were comparatively in larger numbers than either of the other two. Preliminary studies on the life cycle of these three parasites in the host (Green bug) were made during the year under laboratory conditions.

Last year's study on the duration of life cycle of the parasite - **Coccophagus bogoriensis** Kon. - had indicated that it completed the cycle in about 22 days. Extended studies during this year have shown that this parasite needs 24 to 30 days for completion of the life cycle under laboratory conditions. Egg and larval stages together took 15 to 20 days while the pupal stage lasted from 9 to 10 days.

The other parasite belonging to the same genus -- **Coccophagus** sp.— could complete its life cycle in 22 to 27 days, comprising of 15 to 19 days of egg and larval stages and 7 to 8 days of pupal stage.

The third, an Aphelinid parasite - **Marietta javensis** How. - completed its life cycle in 16 to 21 days, with 8 to 11 days as egg and larva, and 8 to 9 days as pupa.

Of these three parasite species, **Coccophagus bogoriensis** Kon. was the one most commonly seen at the Coffee Research Station, Balehonnur.

Further studies on the parasite host complex are proposed to be taken up. These studies may throw some light in understanding this method of natural control that is effected on Green bug.

2. Studies on the minor pests of coffee:

The year under report experienced sporadic occurrences of leaf damaging caterpillars and weevils and a leaf-mining dipterous insect particularly on the young plants in the nursery and on those planted out in the field .

Preliminary studies on some of these minor pests were made to have a better understanding of their habits, biology and their economic importance in order to evaluate suitable measures of control when warranted.

(a) **Leaf - eating caterpillars :**

Collections made in the field included loopers, cutworms and two types of leafrollers, all of which were found associated with coffee. Adults were reared from these in the laboratory and got identified as follows :

1. **Hyposidra talaka** Walk.	Fam. Geometridae
2. **Cleora alienaria** Walk.	Or. Lep.
3. **Curapteryx marginata** Hmps.	
4. **Plusia chalcites** Eop. -	Fam. Agrotidae Or. Lep.
5. **Tiracola plagiata** Walk.	Fam. Agrotidae Or. Lep.
6. **Prodenia litura** F.	
7. **Adroxophyes moderatana** Walk.	Fam. Tortricidae. Or. Lep.
8. **Homona coffeiria**	

These leaf feeding caterpillars were found soon after the summer showers in negligible numbers. From September to November, these were very active, damaging quite an amount of foliage of coffee plants. Adults of these were abundant during August and the following 2 to 3 months. These appear to have at least 4 to 5 generations from May to November, since the duration of life cycle seemed to be completed in less than 4 to 5 weeks.

(b) **Leaf miner** : A leaf mining insect was found to mine in fairly a large number of tender leaves on the nursery seedlings during July and August 1956. This was later identified as **Agromyza coffeae** Herg. belonging to the family Agromyzidae, Diptera. The extensive tunnelling by the maggots inside the leaf and their occurrence in large numbers on many leaves of the young plant results in distorted and crinkled leaves, thus indirectly affecting the normal growth of the plant, atleast for a temporary period. The insect seems to complete its life cycle in about 3 weeks ; the pupal stage consuming about more than half the period. As the monsoons subside and dry weather sets in, two species of hymenopterous parasites appear to check the insect activity. One of these species was later identified as **Closterocerus** sp. Eulophidae, Hym.

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V. MYCOLOGY.

Studies on the life history and control of the major diseases affecting coffee formed the main pre-occupation of this division. Field trials on spraying of coffee to find out efficient economic methods of control of these diseases were continued In addition to the follow-up studies on the trials started earlier with different proprietary fungicides, trials with newer fungicidal formulations were also started during the post-monsoon period of 1956 and the pre-monsoon period of 1957, in order to evaluate their efficacy of disease control as compared with the standard Bordeaux mixture. To find out a suitable time schedule for spraying against leaf disease in the North East Monsoon rainfall areas, field trials have been started in Shevaroys (Madras State) during the pre-monsoon of 1957. A few of the low-volume spray equipment which showed some promise in the previous year's trials, were put to large field-scale tests.

Fundamental work, particularly on the causative organisms of nursery diseases, viz. deter nination of factors influencing their incidence and spread, artificial causation of the diseases and possibilities of their control through fungicidal applications as well as controlled cultural practices were taken up on a priority basis, since such maladies were noticed to be on the increase and causing concern. Routine examination of diseased specimens received from various private estates were continued and necessary remedial measures suggested.

The survey of the incidence, periodicity and seasonal intensity of the diseases at the Research Stations and at the several coffee zones was kept up. This has come in very handy to determine the fluctuations in the intensity of the diseases in the different coffee areas and with sufficient prior information on the prevailing weather conditions and their influences on disease incidence, it has been possible to issue advisory and warning notes to the planters so that they could take up necessary and timely measures to avert any serious crop damages.

FIELD TRIALS.

A. Spray trials against leaf disease caused by "Hemileia vastatrix."

1. Spray experiment to compare the efficacy of different strengths of Bordeaux mixture.

This experiment started in June 1951 to find if spraying with Bordeaux mixture at strengths lower than the standard $\frac{1}{2}\%$ could give efficient control of coffee leaf disease was continued. Post and pre-monsoon spray applications with the different treatments (as described in previous reports) were given in September 1956 and in May 1957. Leaf counts to find out the effective percentage of leaf survival were taken in September 1956 and February 1957. Crop yields for 1956 were also recorded. The details of yield and leaf counts are summarised in Appendix L. (a) & (b).

Leaf counts recorded in September 1956 has shown that 0.5% Bordeaux is significantly superior to the two lower concentrations (0.37% & 0.25%). The leaf counts in February 1957 and the yield records for 1956-57 do not show any significant differences between the three strengths ; however it is seen that both in yield as well as leaf counts, 0.5% has given numerically better results than the lower concentrations.

Observations on the effective percentage of leaf survival in the different treatments from the start of the trial is summarised in Appendix L (a). It is seen that out of the ten observations recorded, in Sep. 56 observation Bordeaux 0.5% has given significantly superior results over the other two (lower concentrations) and in February 1955, the 0.5% is significantly superior to 0.25%. In the rest of the observations no significant differences were noticed; however, in most of the observations the higher concentration has shown better leaf retention. The comparative yields harvested from the different plots and detailed in Appendix L (b) show that though there are no significant differences between treatments, the highest concentration has given numerically higher yields in four out of the six observations.

From the foregoing results, it is seen that for an effective control of leaf disease, any reduction in the concentration from 0.5% now in common use does not seem advisable. The experiment is concluded.

2. **Experiment to find out the efficacy of adding detergents, wetters, spreaders and adhesives to Bordeaux mixture.**

The experiment started in May 1954 to compare the efficacy of adding detergents, wetters spreaders and adhesives to Bordeaux mixture as against plain Bordeaux mixture was continued. Post-and pre-monsoon spray applications were given in Sept-Oct. 1956 and May 1957.

Details of yield and leaf counts are summarised in appendix LI. No significant differences were noticed between the treatments in yield and September 1956 leaf counts. However, in February 1957 leaf counts, Bordeuax mixture + Agral L.N. is significantly superior to the other treatments. It may be mentioned here that in the previous year also, no significant differences were noticed either in yield or in the effective percentage of leaf survival between the treatments.

3. **Comparative trials using Bordeaux mixture and proprietary fungicides:**

(a) **Experiment to compare the efficacy of proprietary copper fungicides with that of Bordeaux mixture:**

This trial started in May 1953 to find out the efficacy of some of the copper fungicides in controlling leaf disease as compared with standard Bordeaux mixture was continued. post and pre-monsoon spray applications were given in Sept-Oct. 1956 and May 1957. The details of yield and leaf counts are summarised in Appendix LII.

No significant differences between the treatments were noticed in yield and in Feb. 1957 leaf counts; however in Sept. 1956 leaf counts, Bordeaux mixture and Fungi-Copper-Geigy were significantly superior to Wetcol. In the previous year's obeservations also, none of the proprietary copper fungicides were significantly superior to Bordeaux.

(b) **Experiment to compare the efficacy of proprietary fungicides with Bordeaux mixture:**

This experiment started in September 1954 to find out the efficacy of some proprietary fungicides in controlling leaf disease as compared with Bordeaux mixture was continued.

Post and pre-monsoon applications of spray were given as per schedule. The details of yield and counts of effective percentage of leaf retention are given in Appendix LIII.

Perenox, Bordeaux and Shell-copper- fungicide have given significantly superior yields over Dithane Z.78 and Blitox, but however between them there were no significant differences. In Sept. 1956 leaf counts, Perenox was significantly inferior to all other treatments. In Feb. 1957 leaf counts Bordeaux and Blitox are significantly superior to Dithane Z.78 and Perenox, but between them there were no significant differences. Results obtained last year and this year show that no proprietary fungicide is superior to Bordeaux mixture. On the other hand, Bordeaux mixture has shown significant superiority over many of the proprietary products tested.

(c) **Experiment to compare the efficacy of Blitox Ipsilon with Bordeaux mixture.**

This trial started in the pre-monsoon period of 1956 was continued. Spray applications were given during September 1956 and May 1957. Leaf counts were taken in September 1956 and February 1957. The percentage disease incidence under the different treatments were also recorded in July 1957. The data is summarised in Appendix LIV.

Though no significant differences were noticed between the treatments both in September 1956 and February 1957 leaf counts, Bordeaux mixture was found to give numerically better leaf retention. The unsprayed control showed the minimum leaf retention. From the disease percentage counts also, it is seen that Bordeaux sprayed plots showed minimum disease, the unsprayed control showing the maximum disease incidence.

4. **Comparative trials using Bordeaux mixture and other fungicides:**

(a) **Experiment to compare Mercurized copper oxychloride with Bordeaux mixture.**

This experiment started in September 1954 to find out the efficacy of Mercurized copper oxychloride in controlling leaf disease as compared with Bordeaux mixture was continued. Post and pre-monsoon spray applications were given as per schedule. The details of the counts of the effective percentage of leaf survival recorded are summarised in Appendix LV.

In Sept. 1956 observation no significant difference is noticed between the treatments, whereas in Feb. 1957, Bordeaux is found to be significantly superior to the highest concentration of Mercurized copper oxychloride and between Bordeaux mixture and the other treatments no significant differences are noticed.

(b) **Experiment to compare Tuzet fungicide (an organic fungicide) with Bordeaux mixture.**

This exploratory trial started in May 1955 was continued. The regular post and pre-monsoon spray applications were given. The percentage of diseased leaves under the different treatments are given below -

Treatments.	Percentage of diseased leaves.	
	Sept. 1956.	Feb. 1957.
A. Bordeaux mixture ½%.	69.90	64.66
B. Tuzet fungicide 0.2%	65.74	66.55
C. -do- 0.1%	62.61	59.67
D. -do- 0.05%	69.34	63.85

Tuzet fungicide 0.1% concentration has given the lowest disease incidence ; however, the differences between the treatments were very little. It may be mentioned here that the bushes treated with Tuzet fungicide showed phytotoxic symptoms viz. chlorosis of interveinal leaf area, partlcularly in the higher concentrations.

(c) **Experiment to compare the efficacy of proprietary fungicides with Bordeaux mixture.**

The trial started during the pre-monsoon season of 1956 to find out the efficacy of certain new fungicides in controlling leaf disease was continued. Spray applications with the different fungicides were given in September 1956 and May 1957. Observations on the effective percentage of leaf survival and the percentage disease are recorded in Appendix LVI.

It is seen that in September 1956 counts, plain Bordeaux, Bordeaux+Tenac sticker and Bordeaux+Ortho sticker are significantly superior to the rest of the treatments In February 1957 counts, Bordeaux+Ortho sticker alone is signiñcantly superior to colloidal copper, M.C.M. copper oxychloride, plain Bordeaux mixture, Cuprokylt, Ultra-sulphur and untreated control ; whereas between Bordeaux + Ortho sticker, Bordeaux + Tenack sticker, Captan 0.4% + Ortho sticker and Captan 0.2% + Ortho sticker, there are no significant differences. It is also observed that Ultra-sulphur and untreated control have given the poorest leaf retention. In the percentage disease counts also, it is Bordeaux and Bordeaux + stickers which have given the minimum disease incidence, control and Ultra-sulphur showing the maximum incidence.

(d) **Experiment to compare proprietary fungicides and 2:4-D with Bordeaux mixture.**

An exploratory trial has been started during the post-monsoon season of 1956 to find out the efficacy of certain proprietary products in controlling leaf disease and consequent leaf-shed. Spray application with the different chemicals was given in 1956 post-monsoon and 1957 pre-monsoon. The details of the experiment are given below :

Locality : L3 Block, C. R. Station, Balehonnur.

Year of starting : 1956.

Plot size : Gross : 3 x 5 = 15 plants

Net : Middle row 5 plants

Treatments : 6 — Non-replicated exploratory trial.

A. Kirticopper — 1 lb. in 40 galls. water.
B. Flit - 406 — 2 lb. in 100 galls. water.
C. do — 4 lb. do
D. Bordeaux — 2 : 2 : 40.
E. 2 : 4-D. — 8 ppm in water.
F. Control — Unsprayed.

Details of assessment of disease percentages just prior to start of trial in 1956 post - monsoon and later in July 1957 are summarised below :—

TREATMENTS	Mean %age of diseased leaves	
	Initial	July 1957
A.	70.60	42.80
B.	61.70	58.60
C.	67.20	65.50
D.	71.80	37.20
E.	68.70	66.70
F.	74.50	89.70

It is noticed that Bordeaux treatment has given the lowest disease incidence and the unsprayed control the maximum disease incidence. 2 : 4 - D, treated plants also showed a high disease incidence.

(e) **Experiment to compare new proprietary fungicides with Bordeaux mixture**

To compare the efficacy of certain new proprietary fungicides in controlling leaf disease, an exploratory trial has been started during May 1957. The details of the trial are given below :

Locality : "Q" Block at the C. R. Station, Balehonnur

Year of Starting : 1957 Plot Size : Gross : 6x5 = 30 plants

Non - replicated exploratory trial. Net : Middle 5 plants

Treatments :—5.

A. Cobredon — 17.6 oz in 40 galls. water } 2 spray applications per
B. Cupricol — 1 lb. do } year

C. Dithane M. 22-0.4% 4 spray applications per year

D. Bordeaux — 2 : 2 : 40. 2 spray applications per year

E. Control — No. spray

Details of assessment of disease percentage recorded just prior to start of trial and later in July 1957 are summarised below :—

TREATMENTS	Mean %age of diseased leaves	
	Initial	July 1957
A.	38.95	62.79
B.	52.85	85.00
C.	34.44	51.54
D.	34.66	44.15
E.	51.45	87.62

It is seen that Bordeaux 2 applications per year and Dithane 4 applications per year have given the minimum disease incidence whereas the untreated control gave maximum disease.

The results from the foregoing trials indicate that 0.5 % Bordeaux mixture now in common use is as good as and in some cases better than the proprietary fungicides tested so far, regarding the efficacy of leaf disease control. Considering the economics also, home-made Bordeaux mixture works out comparatively cheaper than most of the proprietary formulations.

5. **Spray trials in Liaison zones :**

(a) **Comparison of Blitox Ipsilon with Bordeaux mixture regarding efficacy of leaf disease control.**

To find out the efficacy of Blitox Ipsilon in controlling leaf disease as compared with Bordeaux, trials have been started in two private estates in Shevaroys during October 1956. Details of the experiment are given below :

Locality : 1. Glen peak estate, Shevaroys. (Madras State)
2. Vanguard estate, Shevaroys. (Madras State)

Year of starting : 1956.

Treatments : 9

A. Blitox Ipsilon — 5 lb / acre
B. do — 10 lb / acre
C. do — 15 lb / acre
} at 300 galls. per acre

D. do — 5 lb / acre
E. do — 10 lb / acre
F. do — 15 lb / acre
G. Bordeaux 2 : 2 : 40 — strength
H. Blitox 50% W. P. — 1 lb in 40 galls. water
} at 400 galls. per acre.

I. Control — unsprayed.

Replications : 5 **Lay out :** Randomised.

Plot size : Gross — 3 plants of 3 rows
Nett — the middle plant in the middle row.

Observations on leaf retention and disease incidence have shown very little difference between Bordeaux treatment and the various concentrations of Blitox Ipsilon and Blitox 50% W. P.; however all the sprayed plots show less disease than the unsprayed control.

(b) **Time of spray trial in N. E. Monsoon rainfall areas.**

To find out a suitable time schedule for protective spraying against leaf disease in the N. E. monsoon rainfall areas, a trial has been started during the pre-monsoon period of 1957. The details of the experiment are given below :

Locality : Belvedere estate, Shevaroys (Madras State).

Year of starting : 1957.

Treatments : 5

A. 3 sprays	—	April —May	1st spray
		August —September	2nd spray
		November	3rd spray
B. 2 sprays	—	June —July	1st spray
		November	2nd spray
C. 2 sprays	—	April —May	1st spray
		September	2nd spray
D. 1 spray	—	June —July	
E. Control	—	Unsprayed	

Replications : 6 Layout : Randomized

Plot size : Gross — 6 rows of 16 plants — 96 plants

Nett 4 rows of 14 plants — 56 plants

First spray application with 2 : 2 : 40 Bordeaux mixture has been given on 11—5—1957 in treatments A and C. Spray applications were given in treatments B and D on 1—7—1957 The trial is in progress.

(c) **Anti-leaf fall spray trial.**

To find out the efficacy of spraying with 2 : 4 D and different concentrations of Bordeaux mixture in controlling monsoon leaf shed (leaves affected with leaf disease as well as appareantly healthy looking) usually noticed in wind-swept, heavy rainfall and misty areas, trials have been started in two private estates in the Bababudangiris of Chikmagalur zone during May 1957. Details of the trials are given below :

Locality : 1. Galekere estate, Chikmagalur zone.
2. Bagneheddal estate, Chikmagalur zone.

Year of starting : 1957.

Treatments : 5

A. 2 : 4-D—8 ppm in water sprayed just prior to commencement of S. W. monsoon and repeated during one of the early breaks in the monsaon.

B. 2 : 4-D—8 ppm in 40 galls. neutral Bordeaux (2 : 2 : 40) and sprayed as above.

C. 8 : 8 : 40 Bordeaux — sprayed as above.

D. 16 : 16 : 40 Bordeaux — sprayed as above.

E. 2 : 2 : 40 Bordeanx — sprayed the usual two rounds of pre and post monsoon.

Treatments A to D are in addition to the regular pre-and post-monsoon rounds of Bordeaux spraying at 2 : 2 : 40.

Spray applications with the different chemicals have been given during the last week of May and Mid-July.

The trial is in progress.

6. **Low-volume spray trials.**

A series of tests with low-volume spraying equipment conducted during the previous two years indicated that though these effected some economy in spray mixture, the time consumed to give a proper under-surface spray coverage was much more compared to the present standard high volume, high pressure spray equipment. To confirm the earlier findings, some of the promising low volume nozzles were again compare with the high pressure, high volume nozzles, in large field scale tests during the current year. The details of these tests and results are summarised below :

Description of nozzle	Volume per acre	Time per acre	Remarks
1. Low-volume Planta 'O' ...	264 gls.	14 hrs 24 mins.	
2. Broadway Mistifier ... No. 'O' ...	369 gls.	9 hrs. 14 mins.	
3. Peccallo 'O' ...	333 gls.	12 hrs. 13 mins.	

It is seen from the above table that the "Planta 'O' " nozzle has effected a saving in spray mixture equivalent to 21% over standard Peccallo and 26% over Broadway Mistifier nozzles but the time required is 18% extra over Peccallo and 56% extra over Broadway mistifier nozzle.

Comparison of Birchmeyer make low-volume nozzles with standard Peccallo.

Description of nozzle	Volume per acre galls.	Time per acre Hrs.	Mins.
Fitted on Single Head.			
1. Horto-saphire — brass — 0.7 m.m. ...	300	22	30
2. do — steel — 0.7 m.m. ...	320	30	—
3. do — steel — 0.55 m.m. ...	240	30	—
4. Peccallo 'O' ...	333	12	13
Fitted on Double Head.			
1. Horto-saphire — brass — 0.7 m.m. ...	290	16	—
2. do — steel — 0.7 m m. ...	310	16	—
3. do — steel — 0.55 m.m. ...	265	19	—
Fitted on Triple Head.			
1. Horto-saphire — steel — 0.7 m.m. ...	377	17	8
2. do — steel — 0.55 m.m. ...	336	20	—

It is seen from the above results that 'Horto-saphize' nozzle 0.55 m.m. jet has consumed the lowest spray volume (27% saving over Peccallo nozzle), but the time consumed is considerably more (145% extra over Peccallo nozzle). These low-volume nozzles when mounted on a Double-head and used, some reduction in the time required is effected, at the same time keeping the volume more are less constant; but even in this case, the extra time consumed over the high volume nozzle is considerably high.

The foregoing show clearly that the use of the above mentioned low volume nozzles, though effects some saving in the spray volume, considering the extra time required, is not, under the present conditions of application, economical compared to the high-volume, high-pressure spray equipment now in common use.

B. **Relation of nutritional conditions to incidence of leaf diseases:**

Observations on the intensity of the leaf disease incidence recorded in a Manurial Experimental Block where different combinations of N. P. and K are compared against an unmannured control have indicated the same trends as noticed in previous years that there appears to be no direct effect of nutritional conditions to leaf disease incidence.

C. **Nursery diseases:**

1. **Studies of damping - off and collar - rot of nursery seedlings caused by Rhizoctonia Sp.:**

Trials started in 1956 on control of the pre-and post emergence phases of the damping-off disease by use of seed dressing materials, sterilization of soil in germination beds, secondary beds and baskets prior to sowing seed or transplanting seedlings as well as soil drenching sprays with various fungicides applied after transplanting were continued. Artificial infections were also attempted.

(a) **Use of seed dressing materials to check seed decay and pre emergence damping off:**

The experiment using Mercurial and non-mercurial seed dressings carried out in 1955 and 1956 was repeated with the addition of one more treatment i e. Crag Industrial fungicide—974. Following are the observations recorded.

TREATMENTS	Percentage	
	Germination	Damped off
A. Agrosan G. N. 2 oz / 40 lb. seed	93.20	2.70
B. do 1 oz / do	87.00	2.00
C. TB 4452-b 2 oz / do	85.20	9.40
D. Leytosan 2 oz / do	82.70	4.80
E. Leytosol-b 1 in 150 dilution	74.70	2.70
F. Crag fungicide 50 lb. / acre	82.50	4.20
G. Untreated Control	88.50	4.00

Germination is highest in Agrosan G. N. treatment and poorest in Lyetosol-b treatment. A low incidence of damping off was noticed in Agrosan G. N. and Leytosol-b treatments, maximum being in TB-4452-b treatment. No bad effects on the seedlings were noticed due to the treatments except in the case of Leytosal-b treatment, as evidenced by the growth measurements data summarised below:

Treatments	Average length in cm.		Average number of	
	Shoot	Tap root	Lateral roots	Pairs of leaves
A.	10.40	10.00	27	2 5
B.	10.10	10.80	25	2.7
C.	10.20	9.20	27	2.5
D.	10.10	10 00	23	2.4
E.	7.10	7.00	18	1.3
F.	11.00	10.00	26	2.5
G.	10.10	9.80	26	2.2

Excepting for a stunting of growth of both root and shoot systems in the case of Treatment E (Leytosol-b), the seedlings in the other treatments are more or less of comparable growth.

Results obtained from the three years trials using seed dressing materials have shown that such treatments though helped in preventing seed decay and pre-emergence damping off in the initial stages, were found to be ineffective in controlling later incidence of damping off:

(b) **Partial soil sterilization to check pre-emergence Damping off in germination beds :**

The exploratory trial conducted during 1956 to study the effect of sterilizing the soil with Formaldehyde in checking damping off in germination beds, was repeated during 1957. Seeds were sown in beds sterilized with 0.8% Formaldehyde three weeks earlier

Observations on germination and damping-off incidenee recorded are given below :

Treatments.	%age germination after					%age damped off after				
	45 days	60 days	75 days	90 days	110 days	45 days	60 days	75 days	90 days	110 days
1. Formalin treated soil	20.00	82.10	90.00	93.30	93.30	Nil	0.13	0.50	0.53	0.53
2. Untreated soil	42.00	81.40	84.80	87.00	87.00	Nil	0.25	2.25	4.00	6.80

It is seen from the above table that a better germination results from soil treatment with Formaldehyde, though in the very initial stages, a little delay was noticed as compared with the untreated soil. This delay in germination noticed in the early stages is covered up later. Incidence of damping-off also is noticed to be much less in the sterilized soil. Growth measurements of seedlings growing in both sterilized and unsterilized soil showed a better growth performance in the case of Formaldehyde treated case.

(c) **Comparative efficacy of various fungicides in controlling collar-rot and post-emergence damping off-soil sterilization using fungicides :**

(1) The trial started in May 1956 to study the effect of an initial partial soil sterilization using various fungicides with and without a routine monthly soil-drenching with Bordeaux mixture, in checking damping-off was continued upto September 1956.

Continued observations showed that the incidence of damping-off was low in general ; but however, in untreated **control, Leytosol-B, Crag fungicide** and **Iodine** treatments, a light incidence of the trouble was noticed. In spite of the general low disease incidence, it was clearly visible that an initial partial soil sterilization with Formaldehyde, Bordeaux mixture, Cheshunt's compound or ultra-sulphur followed up by monthly routine soil drenching with Bordeaux has checked damping off incidence.

(2) The trial started in 1956 April, to study the effect of routine monthly applications of fungicides to the soil with the seedlings in situ, in checking damping-off was continued. Observations continued upto September 1956 did not show any further disease incidence. The observations recorded since start of trial have shown minimum disease incidence in Cheshunt's compound and Bordeaux treated cases and highest in untreated control and Iodine treatment.

Growth measurements of seedlings recorded in the above two trials showed that except for a slight stunting of growth in the case of Iodine treatment, the other treatments showed no bad effects.

(d) **Artificial inoculations on young seedlings with different culture isolates from damped-off seedlings :**

Isolation from naturally damped-off seedlings have yielded in artificial culture two different fungi, namely **Rhizoctonia** Sp. and a **Fusarium** sp... In order to determine the pathogenicity of the above two isolates, artificial inoculations using the above two fungi on young basket seedlings growing on sterile as well as ordinary unsterilized soil were taken up, from May to July 1957. The details of the treatments and the results of these trials are summarised in the following table.

Treatments	With Rhizoctonia sp. No of seedlings					With Fussarium sp. No. of seedlings				
	Total	Healthy	Infected	Dead	Recovered	Total	Healthy	Infected	Dead	Recovered
A. Sterilized soil inoculated	10	Nil	10	8	2	10	10	Nil	—	—
B. Unsterilized soil inoculated	10	Nil	10	4	6	10	10	Nil	—	—
C. Sterilized soil uninoculated	10	10	Nil	Nil	—	10	10	Nil	—	—
D. Unsterilized soil uninoculated	10	10	Nil	Nil	—	10	10	Nil	—	—

It is seen from the above results that : —

(i) the **Rhizoctonia** isolate is in an active parasite capable of causing damping-off of seedlings whereas the **Fusarium** isolate is non-pathogenic.

(ii) Death of seedlings do not always follow infection. In cases where the infection is localised, the seedlings escape mortality, which indicates that the vigour of the seedlings may have an influence on the recovery prospects.

(iii) Though no differences regarding the number of seedlings infected is seen whether the seedlings are growing in a sterile or unsterile soil medium, it is noticed that death of seedlings following infection is more in the case of sterilized soil. It was also noticed that in the case of sterilized soil infection took place much quicker than in the unsterilized soil. This may be explained by the fact that in a sterile soil media there being no other micro-organisms to compete with the introduced, pathogene, activity and development of latter can take place unhindered resulting in quicker and more fatal infections.

2. **Studies on Brown-eye-spot disease caused by Cercospora sp.**

(a) Trial to assess relative susceptibility of different varieties of arabica coffee under natural conditions :

(i) The trial started in June 1956 with Kents, Coorgs, S. 795 and S. 288 varieties to study their relative susceptibility to incidence of **Cercospora** was continued. Observations on comparative disease incidence recorded during October-November 1956—the most favourable period for the disease—and February-March 1957—unfavourable dry period are furnised in the following table:

Varieties	Percentage disease incidence.	
	Oct.-Nov. 1956	Feb.-March 1957
A. Kents	37.30	3 90
B. Coorgs	26.50	3.30
C. S. 795	38.40	3.60
D. S. 288	28.90	3.70

It is seen from the above table that :

(1) Disease incidence is more during October and November compared to February March period, irrespective of the variety.

(2) During the low intensity period of February and March practically **no** difference in relative susceptibility is noticed between the four varieties under test.

(3) During the high disease intensity period of October — November the differences in relative succptibility between the four varieties are seen to be more.

(4) The order of susceptibility seems to be S. 795, Kents, S. 288 and Coorgs, though the differences are not very wide.

(ii) In order to see whether there is any difference in relative susceptibility to **Cercospora** shown by leaf disease susceptible and resistant arabica varieties, a trial has been started in June 1957, using Kents and S, 795 arabica varieties. Observations on incidenee of **Cercospora** are in progress.

(b) **Comparative efficacy of different fungicides in controlling Brown-eye spot disease in nursery seedlings.**

(i) The trial started in June 1956 to find out possibilities of control of this disease by use of fungicidal sprays was continued. The scheduled monthly spray applications with the different fungicides were taken up. Observations on disease incidence in the various treatments recorded during October and November 1956 the time of peak incidence of the disease are summarized in the following table:

Treatments	Percentage disease incidence
A. Control - untreated	32.70
B. Bordeaux ½%	16.00
C. do 1%	8.80
D. Dithane Z 78	19.50
E. Mercuric copper oxychloride	21.40
F. Captan.....	16.00

It is seen from the above that routine monthly spray applications with the different fungicides have given considerable control of the disease. Bordeaux 1% treated seedlings showed the minimum disease and the unsprayed control, the maximum. In the case of the other fungicides, very little difference in efficacy of control of disease is noticed between them. It was noticed that in the case of the untreated control, there was a steady increase in the intensity of the disease throughout the rainy months reaching a peak incidence during October — November and from December onwards a decrease in disease incidence was observed, but in the case of seedlings treated with the different fungicidal formulations the disease was kept under check even during the favourable period.

In the case of seedlings treated with Mercurized copper Oxychloride, considerable phytotoxic symptoms were noticed. The first few applications did not show any visible external bad effects, but however from the fifth application onwards the treated seedlings began to show symptoms of distress. Malformation of leaves resulting in narrow linear and crinkled leaves, often with chlorosis of interveinal leaf area was noticed. These symptoms progressed more clearly as the number of fungicidal applications increased. From the eigth monthly application onwards, the treated seedlings began to show death of growing tips, resulting in die-back of primary branches as well as the main growing apex. The seedlings remained conspicuously stunted compared with the rest of the seedlings in the trial.

(ii) To test the comparative efficacy of certain new fungicides in contolling **Cercospora** as well as to find out the frequency of such applications necessary for an effective control, a trial has been started during 1957. Following are the details of the trial.

Locality : Nursery at the C. R. Station, Balehonnur

Year of starting : 1957

GRAPH SHOWING INTENSITY OF CERCOSPORA

INCIDENCE AS INFLUENCED BY SEASONAL FLUCTUATIONS

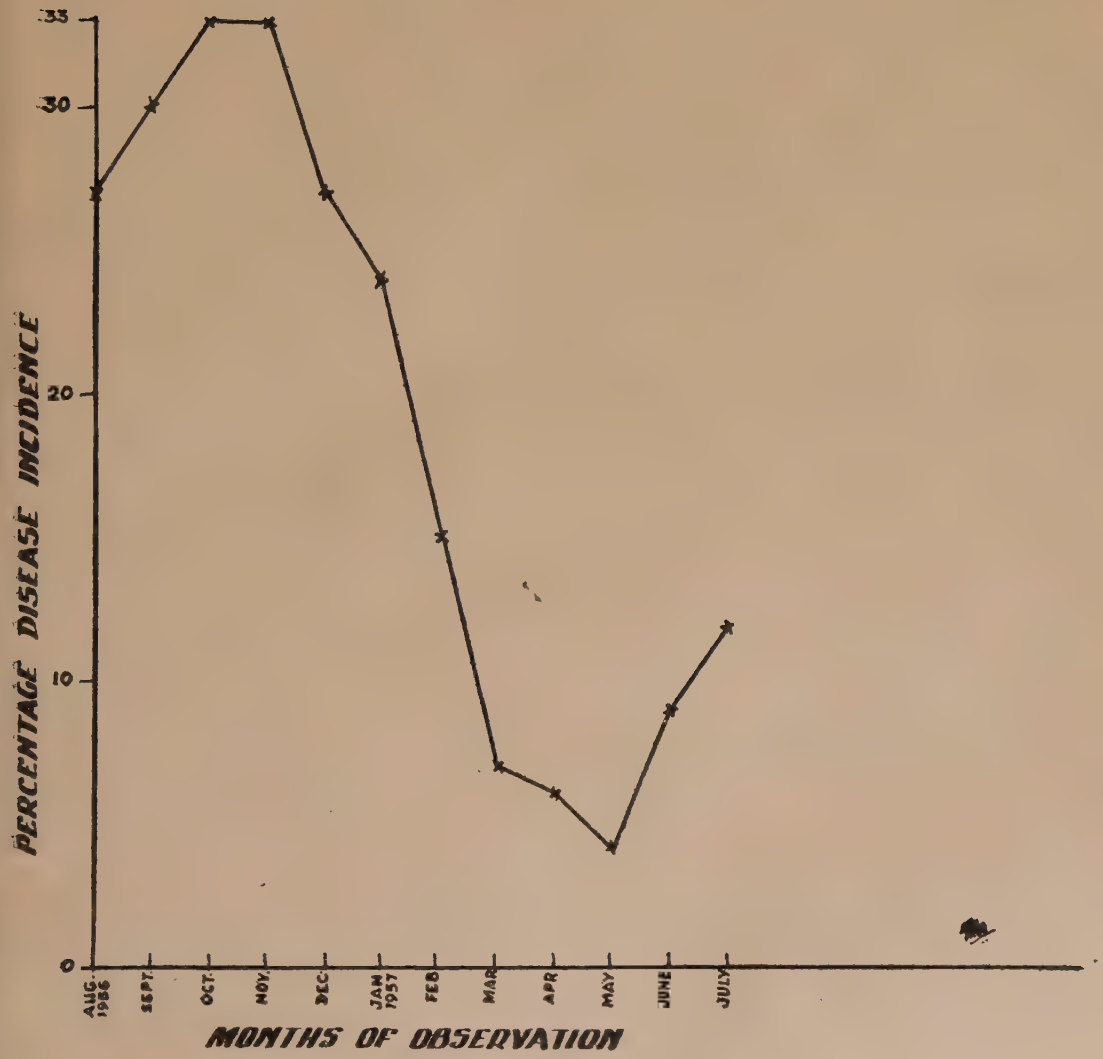

Fig. 9

Treatments : 9

A.	Dithane—M. 22 —0.4% + Ortho sticker	Monthly applications
B.	Flit—406 do	
C.	Bordeaux 1% + Ortho sticker	
D.	Bordeaux 1% without sticker	
E.	Dithane—M 22 —0.4% + Ortho sticker	Fortnightly applications
F.	Flit—406 do	
G.	Bordeaux 1% + Ortho sticker	
H.	do without sticker	
I.	Control—Unsprayed.	

Replications : 4 **Layout :** Randomized

Plot size : 2 rows of 3 seedlings in each row 6 seedlings

The seedlings were transplanted to nursery beds during the middle of June 1957 and the spray applications with the different fungicides were taken up in the first week of July 1957 Observations on the disease incidence are in progress.

(c) **Observational studies on the intensity of disease incidence as influenced by age of seedling and seasonal fluctuations :**

Observations recorded from August 1956 to July 1957 (on seedlings 5 months old till they were 17 months old) showed considerable variations in the intensity of the disease during the different periods of the year corresponding to seasonal fluctuations The age of the seedling has also influenced the intensity of infection to a great extent. The intensity of infection recorded at monthly intervals from August 1956 to July 1957 is depicted in graph. It is seen that from August onwards there is a steady increase in disease incidence reaching a peak incidence in October-November. From December onwards till May, there is a steady decline in disease intensity. From June, the disease is again slowly on the increase. This may be explained by the fact that following the summer showers in April-May, the disease organism starts activity spreading throughout the rest of the rainy months and reaching a peak incidence during October-November. From the end of November onwards, with the onset of cold dry weather and throughout the summer months, the activity of the pathogen is very limited due to prevailing unfavourable weather conditions. It was noticed that from end of November till middle of February, defoliation of affected leaves took place.

Another factor observed is the influence of the age of seedlings on the intensity of infection. The intensity of infection and accompanying defoliation is more in the young stages of the seedlings, the relative incidence being comparatively less as the seedling ages It is seen from the graph that the disease percentages recorded in August 1956 when the seedlings were 5 months old is considerably more as compared to the intensity of disease noticed 11 months later in July 1957 when the seedlings were over 16 months old.

(d) **Incidence of Cercospora in relation to fungicidal and nutritional treatments :**

In order to find out the efficacy of fungicidal and nutritional treatments in either checking the disease incidence or reducing the damaging effects of the disease, a trial has been

started during June 1957, wherein various concentrations of Urea along with and without Bordeaux mixture as a foliar spray or Urea alone applied to the soil are under study. Following are the details of the trial.

Locality : Nursery at the C. R. Station, Balehonnur.

Year of starting : 1957

Treatments : 8

A. Urea 1% foliar spray — 1 gallon for 300 seedlings
B. do + 1% Bordeaux foliar spray at 1 gal. for 300 seedlings
C. 1% Bordeaux foliar spray at 1 gallon for 300 seedlings
D. Urea 0.2% soil application at 5 gall. for 300 seedlings
E. do watering through leaf top covering the soil
F. Urea 0.5% foliar spray at 1 gallon for 300 seedlings + Urea 0.1% soil application at 5 gall. for 300 seedlings
G. Urea 0.5% + 1% Bordeaux for foliar spray + Urea 0.1% for soil application — rate of application as above.
H. Control — untreated.

Replications : 3 **Layout :** Randomized

Plot Size : Gross : 5 x 5 = 25 seedlings
Net : 3 x 3 = 9 seedlings

Time of application of treatments : Fortnightly from July to December.

Note : Except the normal nursery bed preparation practices of mixing jungle soil and compost, no other mannure applications are given as a general treatment.

The seedling were transplanted during the middle of June 1957 and the applieations of the different treatments were started in the first week of July 1957. Observations are in progress.

D. EXPERIMENTS AT THE COFFEE RESEARCH SUB-STATION CHETHALLI (Coorg)

1 Comparative trial with proprietary copper fungicides and Bordeaux mixture :

This trial started in 1953 to test the efficacy of the copper fungicides as compared with the standard Bordeaux mixture was continued Post-and pre-monsoon spray applications were given as per schedule. The following are the details of yield and leaf counts recorded :

Treatments	Effective % age of leaf survival		Yield of ripe cherry in lb. per acre
	September '56	February '57	1956—1957
A. Wetcol.	82.71	40.40	7203
B. Bordeaux 0.5%	76.50	49.50	8553
C. Control.	72.63	45.60	5845
D. Cupravit	83.28	38.40	8122
E. Yellow Cuprocide	75.61	40.96	6796
General Mean :	78.14		7304.

Bordeaux treated plots have given highest yield and the untreated control the lowest.

2. **Comparison of Mercurized copper oxychloride with Bordeaux mixture:**

This experiment started in 1955 to test the efficacy of Mercurized copper ozychloride in leaf disease control as compared with Bordeaux mixture was continued. Treatments were given as per schedule. Following are the observations recorded.

	Treatments.		Effective %age of leaf Survival-Feb '57.
A.	Mercurized copper oxychloride	0.2%	54.50
B.	-do-	0.3%	52.20
C.	-do-	0.4%	56.80
D.	-do-	0.6%	51.00
E	-do-	0.8%	50.00
F.	Bordeaux	0.5%	53.00
	General Mean		52.91

Very little difference between the various concentrations of mercurized copper oxychloride and Bordeaux mixture 0.5% was noticed. Plants sprayed with the former showed phytotoxicity to a considerable extent and were looking very unhealthy and scraggy. The experiment is being discontinued.

3. **Experiment to compare new proprietary fungicides with Bordeaux mixture:**

To find out the efficacy of certain new proprietary fungicides in controlling leaf disease. as compared with Bordeaux mixture, a trial was started in May 1957. Flit 406 is being tried at varying strengths with and without the sticker. Details of the trial are furnished below:

Locality: Coffee Research sub-station, Chethalli.

Year of starting: May 1957.

Treatments: 9

A.	Flit-406.	0.2%	2 sprays a year
B.	-do-	0.4%	-do-
C.	-do-	0.6%	-do-
D.	-do-	0.4% + Tenac sticker.	-do-
E.	Bordeaux mixture	0.5%	-do-
F.	-do-	-do- + Tenac sticker.....	4 sprays a year.
G.	Kirticopper 1 lb. in 40 galls.		2 sprays a year.
H.	Control – untreated.		
I.	Flit-406 0.4% + Tenack sticker -		4 sprays/year

Replications : 4. Layout : Randomized.

Plot size : Gross 3 rows of 5 plants.

Nett : The middle 3 plants of the middle row.

Observations recorded on the percentage disease incidence during July 1957 are furnished below :—

Treatments.	Mean %age of diseased leaves July 1957
A.	60 63.
B.	63.30.
C.	67.15.
D.	73.20.
E.	52.77.
F.	53.12.
G.	63.72.
H.	70.12.
I.	65.07.

It is seen from the above table that Bordeaux with and without sticker has given maximum disease control.

K. V. GEORGE.
Mycologist

APPENDIX V

Meteorological Data of the Coffee Research Station, Balehonnur

1956 — 1957.

Sl. No.	Description		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July
1	Highest Maximum Temperature	F ...	79.1	81.1	81.5	80.5	84.5	83.5	88.5	91.0	93.5	98.9	83.5	77.0
		C ...	26.2	27.3	27.5	26.9	29.2	28.6	31.4	32.8	34.2	37.2	28.6	25.0
2	Lowest Maximum Temperature	F ...	68.2	69.2	71.0	76.0	74.5	77.5	81.0	84.1	85.5	79.5	74.5	69.5
		C ...	20.1	20.7	21.7	24.4	23.6	25.3	27.2	28.9	29.7	26.4	23.6	20.8
3	Highest Minimum Temperature	F ...	66.6	66.4	66.2	66.0	61.4	62.0	64.0	66.5	70.8	70.6	69.0	67.0
		C ...	19.2	19.1	19.0	18.9	16.3	16.7	17.8	19.2	21.6	21.4	20.6	19.4
4	Lowest Minimum Temperature	F ...	62.4	63.0	58.6	59.0	52.7	52.0	57.0	58.5	63.6	62.0	63.8	62.4
		C ...	16.9	17.2	14.8	15.0	11.5	11.1	13.9	14.7	17.6	16.7	17.7	16.9
5	Average Maximum Temperature	F ...	73.0	74.5	77.0	78.3	79.0	80.9	84.4	87.0	89.4	86.9	78.2	72.3
		C ...	22.8	23.6	25.0	25.7	26.1	27.2	29.1	30.6	31.9	30.5	25.7	22.4
6	Average Mininum Temperature	F ...	64.7	64.2	64.0	63.0	58.0	57.8	59.2	63.0	67.7	67.4	67.0	65.5
		C ...	18.2	17.9	17.8	17.2	14.4	14.3	15.1	17.2	19.8	19.7	19.4	18.6
7	Highest Humidity	% ...	97	97	97	97	97	97	97	97	97	97	97	97
8	Lowest Humidity	% ...	92	87	75	83	71	63	51	47	59	73	88	90
9	Average Humidity	% ...	95	94	95	88	80	81	77	79	87	86	94	96
10	Highest No of hrs. of bright sunshine	...	10-24	9-18	9-00	9-12	9-30	10-00	10-18	10-48	11-06	11-18	8-48	6-36
11	Lowest No. of hrs. of bright sunshine	...	0-00	0-00	0-06	0-00	7-30	8-30	5-00	4-42	3-48	0-06	0-00	0-00

APPENDIX V—*(Contd.)*

Sl. No.	Description	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July
12	Average No. of hrs. bright sunshine ...	3-24	4-14	3-46	6-40	9-08	9-27	8-32	9-23	8-31	7-17	2-57	1-08
13	No. of days on which rainfall was below 10 cents...	2	7	4	8	—	—	—	2	3	10	5	2
14	No. of days on which rainfall was between 10 - 50 cents...	11	14	13	7	—	—	—	—	2	5	9	10
15	No. of days on which rainfall was between 50-100 cents...	9	2	4	1	—	—	—	—	2	2	4	4
16	No. of days on which rainfall was between 1″ - 2″...	3	1	3	1	—	—	—	—	1	2	3	7
17	No. of days on which rainfall was above 2″...	2	—	—	—	—	—	—	—	—	—	2	7
18	Total No. of rainy days during the month ...	25	17	20	9	—	—	—	—	5	9	18	28
19	Total Rainfall during the month :												
	In Inches ...	19.96	6.26	12.46	4.13	—	—	—	0.06	3.34	6.69	14.95	37.25
	In Millimeters ...	507.0	159.0	316.5	104.9	—	—	—	1.5	84.8	169.9	379.7	946.1
20	Highest Rainfall during the month :												
	In Inches ...	2.53	1.32	1.91	1.20	—	—	—	0.04	1.08	1.75	3.19	4.32
	In Millimeters ...	64.3	33.5	48.5	30.5	—	—	—	1.0	27.0	44.5	81.0	109.7

APPENDIX VI

Rainfall Data of the Coffee Research Station, Balehonnur : 1956-1957

(Rainfall recorded in Inches and in Millimeters)

Sl No.	MONTH		1946-47	1947-48	1948-49	1949-50	1950-51	1951-52	1952-53	1953-54	1954-55	1955-56	Average of 10 Yrs.	1956-57
1	August	Inches ...	37.93	30.34	39.49	25.52	20.11	19.40	28.28	30.70	27.90	15.32	27.50	19.96
		Millimeters ...	963.4	770.6	1002.8	648.2	510.8	492.8	718.3	779.8	708.7	389.1	698.5	507.0
2	September	Inches ...	11.51	9.80	6.43	14.80	21.12	9.77	3.72	6.07	7.69	13.76	10.47	6.26
		Millimeters ...	292.3	248.9	163.3	375.9	536.5	248.2	94.5	154.2	195.3	349.5	265.9	159.0
3	October	Inches ...	3.56	2.62	6.80	7.99	6.43	6.74	13.07	20.22	6.41	8.37	8.22	12.46
		Millimeters ...	90.4	66.5	172.7	202.9	163.3	171.2	332.0	513.6	162.8	212 6	208.8	316.5
4	November	Inches ...	7.04	1.14	8.59	1.43	1.27	3.12	—	—	—	0.60	2.32	4.13
		Millimeters ...	178.8	29.0	218.2	36.3	32.3	79.3	—	—	—	15.2	58.9	104.9
5	December	Inches ...	1.09	0.91	0.08	—	—	—	1.42	—	0.77	—	0.43	—
		Millimeters ...	27.7	23.1	2.0	—	—	—	36.1	—	19.6	—	10.9	—
6	January	Inches ...	0.36	0.26	—	0.02	—	0.14	—	—	—	—	0.08	—
		Millimeters ...	9.1	6.6	—	0.5	—	3.6	—	—	—	—	2.0	—
7	February	Inches ...	—	—	—	0.74	—	1.50	—	—	0.28	0.46	0.30	—
		Millimeters ...	—	—	—	18.8	—	38.1	—	—	7.1	11.7	7.6	—
8	March	Inches ...	1.86	0.19	0.44	—	0.53	—	—	2.29	1.80	1.12	0.82	0.06
		Millimeters ...	47.2	4.8	11.2	—	13.5	—	—	58.2	45.7	28.5	20.8	1.5
9	April	Inches ...	1.56	9.94	2.16	0.79	3.84	6.29	2.40	9.18	3.54	6.19	4.59	3.34
		Millimeters ...	39.6	252.5	54.9	20.1	97.5	159 8	61.0	233.2	89.9	157.2	116.6	84.8
10	May	Inches ...	5.21	2.41	6.61	3.77	8.43	2.55	0.49	4.40	19.18	3.33	5.64	6.69
		Millimeters ...	132.3	61.2	167.9	95.8	214.1	64.8	12.5	111.8	487.2	84.6	143.3	169.9
11	June	Inches ...	9.90	15.67	10.50	11.57	17.38	13.53	15.36	18.56	20.16	28.30	16.09	14.95
		Millimeters ...	251.5	398.0	266.7	293.9	441.5	343.7	390.1	471.4	512.I	718.8	408.7	379.7
12	July	Inches ...	35.97	30.93	24.60	58.25	29.31	27.72	54.99	43.09	9.52	37.6i	35.20	37.25
		Millimeters ...	913.6	785.6	624.8	1479.5	744.5	704.1	1396.1	1094.5	241.8	955.3	893.8	946.1
	Total	Inches ...	115.99	104.21	105.70	124.88	108.42	90.76	119.73	134.51	97.25	115.06	111.65	105.10
		Millimeters ...	2946.1	2646.9	2684.8	3171.9	2753.9	2305.3	3041.1	3416.5	2470.1	2922.5	2835.9	2669.5

APPENDIX VII

Rainfall Data at the Coffee Research Sub-Station, Chethalli

(Rainfall recorded in Inches and Millimeters)

Month		1955—1956	Average for previous 15 years	1956--1957
AUGUST	Inches ...	5.82	13.33	10.04
	Millimeters ...	147.8	338.6	255.0
SEPTEMBER	Inches ...	5.69	6.35	2.48
	Millimeters ...	144 5	161.3	63.0
OCTOBER	Inches ...	10.75	7.66	11.10
	Millimeters ...	273.1	194.6	281.9
NOVEMBER	Inches ...	0.75	1.98	5.15
	Millimeters ...	19.1	50.3	130.8
DECEMBER	Inches ...	—	0.70	—
	Millimeters ...	—	17.8	—
JANUARY	Inches ...	0.50	0.10	—
	Millimeters ...	12.7	2.5	—
FEBRUARY	Inches ...	0 03	0.25	—
	Millimeters ...	0.08	6.3	—
MARCH	Inches ...	0.18	0.42	0 15
	Millimeters ...	4.6	10.7	3.8
APRIL	Inches ...	4.92	3.55	2.45
	Millimeters ...	125.0	90.2	62.2
MAY	Inches ...	2.93	5.21	8.24
	Millimeters ...	74.4	132.3	209.3
JUNE	Inches ...	18.67	10.44	12.24
	Millimeters ...	474.2	265.2	310 9
JULY	Inches ...	21.75	19.77	22.27
	Millimeters ...	552.5	502.2	565.7
TOTAL	Inches ...	71.99	69.76	74 12
	Millimeters ...	1828.7	1772 0	1882.6

APPENDIX VIII

Soil Cultivation Experiment at the Coffee Research Station, Balehonnur.

Locality : C. R. Station, Balehonnur
Year of Commencement : 1954—55.
Design : Randomized Blocks
Replications : 4
Treatments : 6
Variety : Coorg Arabica
Plot size : 4 x 20 = 80 plants (4.5 cents)
Total area under experiment : 1.08 acre

Treatments	Yield or ripe cherry in lb. per acre			Calculated yield of clean coffee in cwt. per acre		
	1954–55	1955–56	1956–57	1954–55	1955–56	1956–57
A. Trenching - 1½'x¾'x5' long-July ...	3204	4749	2097	5 27	7.22	3.34
B. Trenching-¾'x¾'x5' long-July ...	4092	3030	2609	6 85	4.40	4.10
C. Renovation pitting 1½'x¾'x3' July ...	3673	3382	3475	5.95	5 28	5 65
D. Deep digging - Nov. ...	3872	3273	2901	6.05	5.25	4.45
E. Light digging - Nov. ...	3855	2798	2739	6.56	4.29	4 30
F. Control -weeding only ...	3873	3147	3046	6.38	4.83	4.78
General mean ...	3762	3397	2911	6.18	5.20	4.43
S. E. M. ...	588 7	477.4	354.3			
Significance ...	Basic	No.	No.			

APPENDIX IX

Soil Management Experiment at the Coffee Research Station, Balehonnur.

Locality : C R. Station, Balehonnur
Year of Commencement : 1954–55.
Design : Randomized Blocks
Replications : 4
Treatments : 7
Variety : Coorg Arabica
Plot size : 5 x 16 = 80 plants (4.5 cents)
Total area under experiment : 1.26 acres

Treatments	Yield or ripe cherry in lb. per acre			Calculated yield of clean coffee in cwt. per acre		
	1954—55	1955—56	1956–57	1954—55	1955—56	1956—57
A. Deep digging - August ...	6698	5790	1972	10.65	8.89	3 05
B. Light digging - August ...	6175	7054	2393	10.34	10.04	3.59
C. Deep digging - Nov. ...	4949	6373	1757	8.01	9.78	2.74
D. Light digging - Nov. ...	5842	7232	2192	9.78	10.99	3.36
E. Deep Digging - Apr. ...	5543	6368	1743	9.12	9.06	2.71
F. Scuffling Apr. ...	4455	5573	1644	6.96	8.71	2.48
G. Control-weeding only ...	6151	5184	2560	9 96	7.60	4.08
General Mean ...	5687	6225	2037	9.26	9.29	3.14
S. E. M. ...	540.7	740.8	237.6			
Significance ...	Basic	No.	No.			

APPENDIX X

Manurial Experiment on Robusta

Locality : Coffee Research Station, Balehonnur — Year of commencement : 1951-52

Design : Randomized blocks — Replications : 6

Treatments : 3

		N	P	K
A	Manured at	40	30	40
B	„	80	30	40
C	Control	No Manure		

Plot size: Gross - 4 x 8 = 32 plants (4.7 cents). Nett - 2 x 6 = 12 plants (1.8 cents.)

Total area under experiment : 0.85 acre

Treatment	Yld. of ripe cherry in lb. per acre						Yld. of clean coffee in cwt. per acre					
	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57
A	1793	2427	3231	2494	4099	2724	3.02	4.78	6.01	4.01	7.78	5 11
B	1804	2172	2710	2338	4932	2452	3.27	4.35	4.64	3.76	9.26	4.60
C	1331	2333	3231	2254	4826	2145	2.44	4.60	5.41	3.62	9.06	3.83
Gen mean	1625	2311	3057	2362	4619	2440	2.91	4.58	5.35	3.80	8.70	4.51
S.E.M.		231.8	392.1	259.0	386.6	261.2	10.27					
Significance	Basic	No	No	No	No	No	Basic					

APPENDIX XI

Robusta Manurial and Pruning Experiments - Badra Estate

Locality : Badra Estate, Balehonnur — Year of Commencement : 1952-53

Design : Latin square — Replications : 6

Treatments : 6 — Variety : Robusta

Plot size : Gross-60 plants (8.8 cents) — Total area under experiment : 3 17 acres

Nett : 32 plants (4.7 cents)

	Treatments	Yield of ripe cherry in lb. per acre					Yield of clean coffee in cwt. per acre				
		1952-53	1953-54	1954-55	1955-56	1956-57	1952-53	1953-54	1954-55	1955-56	1956-57
A	Control No manure	3836	3417	4178	3340	5465	6.80	5.49	7.09	5 67	10.25
B	No manure + pruned	3586	3346	3889	3657	5507	6.31	5.67	7.31	5.88	10.33
C	Manured @ N-P-K 40-30-40	3707	3705	3687	4739	5100	6.48	5 96	6.91	8.89	9.56
D	do 80-30-40	4038	3623	4133	4232	5236	7.10	5.39	7.75	7.56	9.82
E	do 40-30-40+ pruned	4265	3664	5046	4623	5178	7.49	5.89	10.36	9.08	10.17
F	do 80-30-40+ pruned	3925	3665	4164	4677	4928	6.79	6.68	7.81	8.77	9.68
Gen. mean		3893	3570	4183	4212	5235	6.81	5.88	7.87	7.64	9.97
S. E. M.		693.7	432 2	421.5	425.8	429.1					
Significance		Basic	No	No	No	No					

APPENDIX XII.

Manurial and Pruning Experiment on Robusta

Locality : Devadhanam estate, Balehonnur
Year of commencement : 1952—53
Design : Latin square
Replications : 6
Variety : Robusta
Treatments : 6
Plot size : Gross — 60 plants (8.8 cents.)
Nett — 32 plants (4.7 cents.)
Total area under Experiment: 3.17 acres

	Treatments	Yield of ripe cherry in lb. per acre					Yield of clean coffee in cwt per acre				
		1952-53	1953-54	1954-55	1955-56	1956-57	1952-53	1953-54	1954-55	1955-56	1956-57
A	Control-No manure	5428	3097	3682	2975	6697	9.27	4.98	6.25	4.78	12.56
B	No manure + pruned	5983	2812	4393	2604	5387	8.93	4.52	8.24	4.18	10.10
C	NPK 40-30-40	5817	3472	3781	2546	6472	8.50	5.58	7.09	4.77	12 13
D	NPK 80-30-40	5688	3466	4543	2894	5872	9.82	5.03	8.92	5.17	11.01
E	NPK 40-30-40+ pruned	6545	3167	4156	3221	7419	11.52	5.09	8.53	6.33	14.51
F	NPK 80-30-40+ pruned	6040	3371	4699	3078	7294	10.79	6.27	8 81	5.77	14.26
	Gen. mean	5917	3231	4209	2886	6 24	10.31	5.25	7.97	5.17	12.43
	S.E.M.	417.2	333.3	390.3	346.8	514.8					
	Significance	Basic	No.	No.	No.	No.					

APPENDIX XIII.

Experiment on the Influence of Topping on Growth & Yield of Robusta Coffee

Locality : Byregudda estate, Balehonnur
Year of commencement : 1951—52
Design : ABBA
Replications : 12
Treatments : 2
Variety : Robusta
Plot size : 32 plants (5.95 cents)
Total area under expt : 1.43 acres

	Treatments	Average increase in length of branches in cm.				Mean stem girth measurements. cm.		Yield of ripe cherry in lb. per acre	
		1952-53	1953-54	1954-55	1955-56	1955-56	1956-57	1955-56	1956-57
A	Topped at 3 ft. height	1.27	0.53	0.20	0.23	5.73	6.58	469	532
B	Topped at 4 ft. height	1.18	0.42	0.19	0.64	5.64	6.41	668	654
	Gen. mean	1.23	0.48	0.20	0.44	5.69	6.50	568	593
	S.E.M. %	—	9.20	0.01	7.09			12.62	7.86
	Significance	Basic	Yes	No	Yes			No.	No.

APPENDIX XIV (a)

Blossom Berry observations on Station Selections — 1955

Sl. No.	Arabica	Mean percentage of berry retention					
		April	May	June	August	September	October
1.	S. 288.	91.40	67.52	55.24	43.95	43.39	42.63
2.	S. 333.	97.50	90.13	75.35	69.36	69.36	62.64
3.	S 645.	75.73	73.34	62.52	44.05	36.56	31.05
4.	S. 795.	71.88	82.41	62.91	55.15	45.01	43.89
5.	Kents.	73.62	46.39	31.03	28.47	27.53	24.02
	Mean	82.03	71.96	57.41	48.20	44.36	40.85

APPENDIX XIV (b)

Blossom Berry observations on Station Selections — 1956

Sl. No.	Arabica	Mean percentage of berry retention					
		April	May	June	July	August	October
1.	S. 288.	76.73	64.84	50.65	42.34	42.34	42.34
2.	S. 333.	84.00	70.27	49.15	49.15	49.15	49.15
3.	S. 645.	93.11	88.90	79.51	42.69	42.69	42.69
4.	S. 795.	80.20	67.79	53.62	41.36	41.36	41.36
5.	Kents.	78.06	76.51	53.01	53.01	53 01	53.01
	Mean.	82.42	73 66	57.19	45.71	45,71	45.71

APPENDIX XV

Method of preservation trial (Robusta) — average of 4 replications

Treat-ment	Seeds preserved in	Percentage of germination of seeds sown on				
		8.3.57	22.3.57	12.4.57	26.4 57	10.5.57
A	Control-no treatment	71 6	70.3	68 9	61.1	62 2
B	Naphthalene	68.4	66.5	61.1	41.3	45.2
C	Charcoal	70.1	77.0	68.5	75.5	70.6
D	Ash	70.4	68 6	59.3	49.3	49.1
	Gen. Mean	70.1	70 6	64.5	56.8	56.7
	S. E. M.	1.06	1.16	1.65	1.03	1.14
	Significance	No.	Yes	Yes	Yes	Yes
	Critical diff.		5.34	7.57	4.74	5.24
	Conclusions		C A D B	$\overline{A C}$ $\overline{B D}$	C A D B	C A $\overline{D B}$

APPENDIX XVI

Studies on the Method of Storage of Seeds-Average of 4 replications

Treatment.	Seeds stored in.	Percentage germination of seeds sown on Arabica						Robusta				
		25-2-57	11-3-57	25-3-57	8-4-57	22-4-57	6-5-57	8-3-57	22-3-57	12-4-57	26-4-57	10-5-57
A.	Control-in gunny	61.9	60.3	60.7	53.8	51.2	42.8	66.8	68.5	64.5	58.4	53.6
B.	In tins.	63.5	66.4	59.2	59.4	53.4	48.8	70.5	68.0	62.4	55.2	56.7
C.	In cloth bags.	61.2	58.0	59.3	58.6	56.7	47.9	71.5	70.4	66.7	59.7	55.7
D.	In alka-thene paper.	62.5	63.2	60.2	60.9	50.3	31.8	66.2	65.0	55.8	54.0	52.5
	Gen. mean	62.2	62.0	59.9	58.1	52.9	42.8	68.7	68.0	62.4	56.8	54.5
	S. E. M.	1.45	2.45	1.48	1.01	2.86	1.22	1.81	1.11	0.99	2.64	1.13
	Significance.	No.	No.	No.	Yes.**	No.	Yes.**	No.	Yes.*	Yes.**	No.	No.
	Cr. Diff.	—	—	—	4.65	—	5.61	—	5.11	4.55	—	—
	Conclusions				D B C A		B C A D		C A B D		C A B E	

APPENDIX XVII.

Trials on germination with different composition of seed beds

Treatments	Percentage of germination of Arabica	Robusta
A. Soil.	56.1	68.5
B. Jungle soil.	59.5	68.5
C. Jungle soil + sand (1:1)	61.1	69.7
D. Jungle soil + Compost + sand (1:1:1)	58.5	70.3
E. Jungle soil + compost + sand (2:2:1)	62.1	71.7
F. Jungle soil + Compost + sand (3:3:1)	62.3	71.7
General mean.	59.9	70.1
S. E. M.	1.59	1.07
Significance.	No.	No.

APPENDIX XVIII

Pre-treatment of Seeds (average of 4 replications)

Treatment	Percentage germination of Arabica		Robusta	
Treated with :—	With parchment cover	Without parchment cover	With parchment cover	Without parchment cover
A. Conc. H_2SO_4 for 3 minutes.	46.5	0.0	57.2	1.4
B. -do- for 5 minutes.	53.8	0.0	58.5	2.9
C. 50% H_2SO_4 for 3 minutes.	58.3	0.0	63.8	13.0
D. -do- for 5 minutes.	62.3	4.3	68.1	8.7
E. 2, 4-D. 15 ppm for 24 hours.	61.2	69.8	72.5	72.7
F. *L* N A A -do-	62.0	71.7	71.4	75.4
G. *B*. I. B. A. -do-	64.4	76.3	70.0	76.6
H. *B*. I. a. a. -do-	63.2	70.4	68.5	74.3
General mean.	59.0	36.6	66.2	40.4
S. E. M.	3.23	2.05	1.52	1.57
Significance.	Yes*	Yes**	Yes**	Yes**
Critical difference.	12.93	8.21	6.08	6.28
Conclusions.	GHDFECBA	GFHED	EFGHD CBA	GFHE CD BA

APPENDIX XIX

Pre-treatment of seeds with their parchment cover.

Chemical	Germination percentage of ARABICA Concentration of chemical				ROBUSTA Concentration of chemical			
	25 ppm	50 ppm	100 ppm	Mean	25 ppm	50 ppm	100 ppm	Mean
1. *L*. N. A. A.	46	50	38	44.6	70	68	84	74.0
2. *B*. I. A. A.	72	68	56	65.3	54	66	62	60.6
3. I. B. A.	62	79	64	65.3	86	60	78	74.6
4. 2, 4-D	68	48	50	55.3	64	48	62	58.0
Mean.	62	59	52		68.5	60.5	71.5	

APPENDIX XX

Trial of effect of drying of coffee seeds on germination
average of 5 replications

Treatments	Percentage germination of seeds sown on				
	7-1-1957	12-2-1957	12-3-1957	12-4-1957	13-5-1957
A. Sun drying with parchment cover in tact ...	6.3	8.4	17.4	23.7	11.4
B. do without parchment cover ...	21.5	24.9	18.9	19.2	14.6
C. Shade drying with parchment cover in tact ...	37.5	30.8	44.6	60.4	36.5
D. do without parchment cover...	54.6	54.7	48.8	40.6	20.1
E. General mean ...	29.9	29.7	32.4	36.0	20.7
S. E. M. ...	3.41	2.32	3.11	1.86	1.47
Significance. ...	Yes**	Yes**	Yes**	Yes**	Yes**
Critical difference. ...	14.77	10.05	13.45	8.05	6.36
Conclusions. ...	D C B A	D C B A	D C B A	C D A B	C D B A

APPENDIX XXI

Soil Cultivation Experiment.

Locality : Coffee Research sub-station, Chethalli
Year of commencement: 1953-54
Design : Latin square — Replications : 6
Treatments : 6 — Variety : Coorg arabica
Plot size : Gross - 160 plants — Total area under experiment : 4.80 Acres
Nett - 112 plants

Treatments	Yld. of ripe cherry in lb. / acre			Yld. of clean coffee in cwt. / acre		
	1954-55	1955-56	1956-57	1954-55	1955-56	1956-57
A. Trenching 1½' deep ...	1733	1710	7001	2.58	2.54	10.42
B Trenching ¾' deep ...	1538	1680	7321	2.29	2 50	10.89
C. Renovation pitting ...	1763	1792	7136	2.62	2.67	10.61
D. Light digging ...	1358	1920	7106	2.02	2.86	10.57
E. Heavy digging ...	1613	1920	7047	2.40	2.86	10.48
F. Control - Weeding only ...	1920	1837	7847	2.86	2.73	11.67
General Mean ...	1650	1810	7243	2.46	2.69	10.71
S. E. M. % ...	8.89	6.81	15.85			
Significance ...	No	No	No			
Crit. Diff. ...	433.4	—	—			

APPENDIX XXII

Comparative trials of clonal progeny - B. A. Series I.

Locality : Balehonnur (Mysore State)
Variety : Arabica hybrids
Replications : 8
Area of experimental block : 59.5 cents
Guard rows : One on either side

Layout : Randomized block
Plot : 3 plants in a row
Treatments : 20 cultures of the B. A. series
Spacing : 6' x 6'
Shade : Natural shade

Mean yield of replications - calculated yield of clean coffee in cwt. per acre (1200 plants)

Cultures	Yield			Cultures	Yield		
	1954-55	1955-56	1956-57		1954-55	1955-56	1956-57
B. A. 5	0.60	1.49	0.95	B. A. 24	1.14	0.31	2.48
B. A. 6	1.05	1.68	1.07	B. A. 25	1.44	1.11	1.47
B. A. 11	2.25	2.84	3.95	B. A. 26	0.75	1.41	1.79
B. A. 12	5.22	3.35	2.34	B. A. 27	1.05	1.51	1.18
B. A. 13	2.79	1.19	3.65	B. A. 30	0.48	1.26	1.23
B. A. 19	5.76	2.21	2.29	B. A. 31	2.85	3.94	0.98
B. A. 20	3.15	1.51	3.12	B. A. 32	1.08	1.60	0.49
B. A. 21	0.96	1.08	1.59	B. A. 34	1.41	1.68	0.31
B. A. 22	2.43	2.39	1.65	B. A. 35	2.61	2.88	3.07
B. A. 23	3.45	2.26	3.05	B. A. 36	2.04	2.18	1.67

APPENDIX XXIII

Comparative trials of clonal progeny - B. A. Series II

Locality : Balehonnur (Mysore State)
Variety : Arabica hybrids
Replications : 6
Area of Experimental block : 45.0 cents
Spacing : 6' x 6'
Guard row : One on either side
Shade : Natural shade

Layout : Randomized block
Plot : 3 plots in a row
Treatments : 15 arabica cultures of B. A. series and seedling progeny of 645 - 1/6 (B.A. 19)

Mean yield of replications - calculated yield of clean coffee in cwt. per acre (1200 plants)

Cultures	Yield	Cultures	Yield
	1956—1957		1956—1957
B. A. 1	1.90	B. A. 15	0.10
B. A. 4	1.12	B. A. 16	4.49
B. A. 7	0.20	B. A. 17	0.15
B. A. 8	0.22	B. A. 18	5.49
B. A. 9	1.46	B. A. 19 (645-1/6)	2.75
B. A. 10	1.07	B. A. 28	6.15
B. A. 13	1.90	B. A. 29	0.63
B. A. 14	0.20	B. A. 33	2.78

APPENDIX XXIV

List of inter-specific crosses established at the Coffee Research Station, Balehonnur

Sl. No.	Culture No.	Parentage	Age in years	Chromosome number - recorded
		I. Robusta X Kents arabica		
1	594	S. 274—1/11 robusta X S. 450—2/1 Kents ...	19	2n = 33
2	905	S. 450—2/1 x 594—2 ...	14	One plant with 2n = 33 One plant with 2n = 55 21 plants with 2n = 44
3	908	S. 594—2 X S. 274—1/11 ...	14	4 plants with 2n = 44
4	988	S. 594—2 open pollinated ...	13	
5	1059	S. 450—2/1 X 594—2 ...	11	
6	1060	S. 594—2 X 450—2/1 ...	10	
7	1047	S. 288—23 (1st gen. of S. 26) X 594—2 ...	10	
8	1061	S. 594—2 X 288—23 ...	10	
9	1156	S. 905—1/7 X 286—14 Kents ...	9	One plant with 2n = 44
10	1204	S. 905—1 7 selfed progeny ...	9	
11	1205	S. 905—2/12 open pollinated ...	9	
12	1206	S. 905—3/9 selfed progeny ...	9	
13	1207	S. 908—3 open pollinated ...	9	4 plants with 2n =44
14	1283	S. 905—1/7 X 286—2 Kents ...	7	
15	1284	S. 905—1/7 X Coorg—6/12 ...	7	One plant with 2n =44
16	1285	S. 905—2/12 X 645—2/11 (F_2 of S. 31 X S. 22...	7	
17	1564	S. 31 X 905—1/7 ...	2	
18	1834	S. 905—1/7 X 33—4 (F_1 of S_6 31 X S. 22)...	1	
		II. Robusta X Arabica		
19	328	S. 26 X Robusta ...	24	One plant with 2n = 33
20	877	S. 328—1 open pollinated ...	15	One plant with 2n = 66
21	756	S. 328—3 open pollinated ...	17	
22	1261	S. 877—2/3 selfed progeny ...	7	One plant with 2n = 44
23	1275	S. 877—2/3 X S. 645—6/7 (F_2 of S. 31 X S. 22)...	7	
		III. Robusta X Arabica variety Margogype		
24	818	S. 274—1/11 X 218 Margogype—2/5...	16	One plant with 2n = 44
		IV. Congensis X Arabica		
25	836	Kent 7—10 X Congensis ...	15	One plant with 2n = 33 One plant with 2n = 55
26	885	C congensis X S. 274—1/11 ...	15	
27	1104	S. 885—3/2 open pollinated ...	11	
28	1098	S. 885—4/1 selfed progeny ...	10	
29	1712	S. 275—4/3 Robusta X C. liberica ...	2	
30	1713	S. 273—4/3 Robusta X C. eugenoides...	2	
31	1715	C. excelsa X C. eugenoides ...	2	
32	1721	C. liberica 3/1 X C. eugenoides ...	2	

APPENDIX XXV

Species, varieties, forms and selections of coffee obtained from foreign institutions and planted on the station since 1953

Species other than arabica.

I	1	Coffea robusta laurentii
	2	C. canephora
	3	C. canephora (Game)
	4	C. roubsta from Saigon
	5	C. robusta from Monrovia
	6	C. robusta L. 215 and L. 36
II	1	C. liberica aruwimiensis
	2	C. liberica arnoldiana
III	1	C. Dewevrei
	2	C. Dewevrei Excelsa
IV		C. stenophylla
V		C. congensis
VI		C. racemosa (Two types)
VII		C. eugenoides
VIII		C. salvatrix
IX		C. kapakata
X		C. ligustroides

XI **Hybrids**

Kawisari-B
Kawisari-D

XII **Varieties, forms and selections of arabica**

1	Bourbon amarelo	15	Blue Mountain
2	Bourbon vermelo	16	San Ramon
3	Caturra amarelo	17	Philippinian
4	Laurina Margogype	18	Gaudalope
5	Mundo Novo	19	Bourbon Mayagese
6	Typica	20	Pretoria
7	Bourbon	21	Columnaris
8	Pache	22	Kona
9	Local Bronze	23	Padang
10	Le Roy (Laurina)	24	Murta
11	Sumatra	25	Mibirizi
12	Jackson	26	S. 8-Taffarikela
13	Surinam	27	S. 9 Arba Gougou
14	Blue Mountain - Kenya	28	S. 12 Kaffa

APPENDIX XXV (Contd.)

29 Kabare
30 S. 16 Wallamo
31 S. 17 Yrgalem
32 S. 2B-Ennerio
33 Salvador
34 Togakouma
35 Macenta
36 Colombie
37 Costa Rica
38 Gimma M'Buni
39 Dalle (mixed green)
40 Dilla and Alghe
41 Dalle (Melville)
42 Rume Sudan
43 Mazeron
44 Reunion
45 Mysore
46 Java Foumban
47 Nkougam
48 Kenya
49 Kauti
50 Martinique
51 Antique
52 Tumbadir
53 Los Palmas
54 Green Lipped
55 Puerto Rico
56 Gimma Gala Sidamo
57 Madagascar
58 Sudan Barbuk
59 Guinea Pita
60 Amphillo
61 Erecta
62 Geisha
63 KP 423
64 N. 205
65 H. 66
66 KP. 162
67 KP. 532
68 N. 39
69 N. 197
70 K. 7
71 Dilla (Melville)
72 Cundinamarca
73 Mokka
74 Java Noun
75 Nicaragua
76 Moka Blao
77 Granza Blonay
78 Mibirizi de Mulungo
79 Local Bronze de Mulungu
80 Barbarino
81 Darnum
82 Walkite
83 Maragogype
84 Moka Dilla Sidamo
85 San Salvador
86 Haraar Arba Gougou
87 Limma Gimma Kaffa
88 Haraar Dugda Limita Arussi
89 Badabuna Gimma Kaffa
90 Babacca Kaffa
91 Misan Taffari Kela
92 Eniamba Kaffa
93 Haraar Bacca Haraar
94 Purpurescence
95 Semperflorence
96 Polysperma
97 Margogype vermelo
98 Caturra
99 Cumbaya - Normal
100 Cumbaya - Abnormal
101 Villalobus
102 Kents (Kenya)
103 C. arabica H. I.
104 C. arabica A. C.98
105 S. 16 (P. R.)
106 F. 502
107 C. arabica Rume Sudan
108 A. C. 53
109 S. L. 34
110 Kent (Ruiru)
111 Self pollinated Geisha type from 3 individual trees
112 Puerto Rican Selections from private estates, 4 types
113 Columnaris - 2 types
114 Cera
115 Augustifolia
116 Anormalis
117 Xanthocarpa
118 Goiba

APPENDIX XXVI

Progressive increase in the supply of seed coffee of Station Selections from 1949

Year	Arabica Selections lb.	Kents Arabica lb.	Robusta S. 274 lb.	Robusta lb.	Excelsa & Liberica. lb.	Total lb.
1949.	150	262	62	759	2	1235
1950.	253	173	47	506	—	979
1951.	400	366	40	1046	1	1853
1952.	695	80	45	1139	—	1959
1953.	888	45	35	875	9	1852
1954.	1456	20	106	720	31	2333
1955.	5421	—	77	800	39	6337
1956.	10669	—	189	1164	27	12049
1957.	13397	—	45	296	19	13757
Total	33329	946	646	7305	128	42354

APPENDIX XXVII

Yield data of multiple stem Vs. Single stem system of growing coffee-Experiment 1.

Locality : Balehonnur (Mysore State). Age of plants : 11 years from seed. Period of conversion : May 1950
Variety : S.288, S.333, S.433, S.434 and Kents arabica (each variety having 12 rows of 16 plants in each row).
Layout : AB,BA pattern. Shade : Natural shade. Spacing : 6ft. X 6ft.
Treatments: A. Single stem. Area of Experimental block : 95.2 cents.
B. Multiple stem.

Year	Description of crop	Yield of ripe cherry (actual) in lb. and calculated yield of clean coffee in cwt/acre (1200 plants) A. Single Stem.							B. Muliple Stem.						
		S.288	S.333	Kents	S.433	S.434	Kents	Mean.	S.288	S.333	Kents	S.433	S.434	Kents	Mean.
1952	Ripe cherry	63	83	19	7	22	22	36	21	8	7	4	5	3	8
	Clean coffee	1.17	1.52	0.35	0.13	0.42	0.41	0.66	0.38	0.15	0.13	0.07	0.09	0.06	0.15
1953	Ripe cherry	55	98	32	1.03	116	10	69	177	83	28	99	135	8	88
	Clean coffee	1.02	1.82	0.60	1.92	2.16	0.18	1.28	3.28	1.53	0.52	1.83	2.52	0.15	1.64
1954	Ripe cherry	243	421	226	227	416	374	318	463	338	370	452	643	160	404
	Clean coffee	4.52	7.83	4.20	4.22	7.74	6.96	5.91	8.6	6.28	6.88	8.41	11.96	2.98	7.52
1955	Ripe cherry	180	128	115	49	62	75	101	144	125	113	73	56	84	99
	Clean coffee	3.34	2.38	2.13	0.91	1.15	1.39	1.88	2.68	2.32	2.12	1.36	1.04	1.56	1.85
1956	Ripe cherry	643	597	404	328	539	248	460	880	622	267	225	367	117	413
	Clean coffee	11.96	11.14	7.51	6.10	10.03	4.61	8.56	16.37	12.46	4.97	4.19	6.82	2.18	7.83
1957	Ripe cherry	206	119	45	74	58	40	90	147	118	53	92	135	70	103
	Clean coffee	3.83	2.21	0.84	1.38	1.08	0.74	1.68	2.73	2.19	0.99	1.41	2.52	1.30	1.86
Mean-	Ripe cherry	231.67	241.00	140.17	131.33	202.17	128.17	179.00	305.33	215.67	139.67	157.50	223.50	73.67	186.00
	Clean coffee	4.31	4.48	2.61	2.44	3.76	2.38	3.33	5.67	4.15	2.60	2.88	4.16	1.37	3.47

Note : 1. Six pounds of ripe cherry has been taken to yield 1 lb. of clean coffee.
2. During February 1957, one of the multiple stems in all the plants under Treatment B was cut and removed. A new sucker is developing for forming one of the multiple stems for the 2nd cycle.

APPENDIX XXVIII

Yield data of Multiple stem Vs. Single stem system of growing coffee - Experiment II.

Locality	: Balehonnur (Mysore State).	Layout	: Randomized block.	Variety	: Arabica hybrids
Plot	: 4 x 16 = 64 plants.	Treatments	: 4 during the year of conversion.	Spacing	: 6 ft. x 6 ft.
Replications	: 4.	Age of plants	: 24 years from seed.	Shade	: Natural shade.
Area of the experimental plot:	105.8 cents.	Period of conversion	: March 1951.		

Treatments:—A. Single stem.

B. Primary branches on one side were pruned off during March 1951 to encourage free growth of suckers for growing multiple stems. After crop harvest, during March 1952, the main stem was stumped to a height of 2 feet from the ground level retaining a primary branch to form the lung branch: The three suckers form the multiple stems.

C. Extended centering upto one foot from the centre was done during the year of conversion (1951) to facilitate free growth of 3 suckers for forming the multiple stems. After crop harvest, during March 1952, the main stem was stumped to a height of 2 feet from the ground level retaining a primary branch to form the lung branch. The three suckers form the multiple stems:

D. Except the two top primary branches all the other branches were cut down during the year of conversion (1951) to facilitate free growth of three suckers. After crop harvest, during March 1952, the topmost primary branch was retained to act as lung branch and the three suckers form the multiple stems.

Mean yield of ripe cherry per plot (actual) in lb. and calculated yield of clean coffee in cwt/acre of 1200 plants.

Treatments	Ripe cherry (actual)						Clean coffee per acre (calculated)						Mean of six years. cwt.
	*1952 lb.	1953 lb.	1954 lb.	1955 lb.	1956 lb.	1957 lb.	*1952 cwt.	1953 cwt.	1954 cwt.	1955 cwt.	1956 cwt.	1957 cwt.	
A.	38.63	47.14	208.46	100.44	190.83	393.70	1.08	1.31	5.81	2.80	5.32	10.98	4.55
B.	22.11	12.24	262.16	92.31	192.90	388.90	0.62	0.34	7.31	2.58	5.40	10.85	4.52
C.	24.62	26.11	272.46	110.06	251.00	380.00	0.68	0.73	7.66	3.07	7.00	10.60	4.96
D.	38.38	34.73	246.84	99.38	225.49	371.00	1.07	0.97	6.77	2.77	6.29	10.35	4.70

*Crop of the year of conversion.

Note:—1. 6 lb. of ripe cherry has been taken to yield 1 lb. of clean coffee.

2. During February 1957, one of the multiple stems in all the plants under treatments B, C. & D. was cut and removed. A new sucker is developing for forming one of the multiple stems in the 2nd cycle.

3. On the average of six years' yields, treatment B has registered a decrease of 0.7% over that of the Single Stem (Treatment A) while Treatments C and D have registered an increase of 9.1% and 3.3% respectively over the Single Stem.

APPENDIX XXIX.

Yield data of the Multiple Stems Vs. Single stem system of growing coffee—Experiment III.

Locality	: Balehonnur (Mysore State).	Lay-out	: AB,AB pattern.
Variety	: Arabica hybrids	Plot	: 16 plants in a row.
Period of conversion	: March 1951.	Spacing	: 6' x 6'.
Replications	: 21.	Age of plants	: 13 years form seed.
Area of Exptl plot	: 52 cents.	Shade	: Natural Shade.
Treatments	: A. Single stem. B. Multiple stem.		

Mean yield of ripe cherry per plot (actual) in lb. and calculated yield of clean coffee in cwt. per acre of 1200 plants.

Year.	Description of crop.	Yld. Ripe cherry in lb./Clean coffee cwt. A. Single stem	B. Multiple stem
‡1952	Ripe cherry.	5.78	3.90
	Clean coffee.	0.64	0.44
1953.	Ripe cherry.	19.43	8.03
	Clean coffee.	2.17	0.89
1954.	Ripe cherry.	24.72	21.49
	Clean coffee.	2.76	2.40
1955.	Ripe cherry.	18.99	15.20
	Clean coffee.	2.12	1.69
1956.	Ripe cherry.	11.94	24.82
	Clean coffee.	1.32	2.80
1957.	Ripe cherry.	38.29	42.27
	Clean coffee.	4.35	5.75
Mean.	Ripe cherry.	20.03	19.28
	Clean coffee.	2.23	2.33

‡Crop of the year of conversion.

Note:—1. 6 lb. of ripe cherry has been taken to yield 1 lb. clean coffee.
2. During Feb. 57, one of the multiple stems in all the plants under treatment B was cut down. A new sucker is developing for forming one of the multiple stems in the 2nd cycle.

APPENDIX XXX.

Yield data of multiple stem Vs. Single stem system of growing coffee.

Locality	: Balehonnur (Mysore State).	Lay-out	: Opposite quadrants on a rectangular block are on each of the 2 treatments.
Variety	: Robusta.		
Treatments	: A. Single Stem. B. Multiple Stem.		
Spacing	: 9' X 9'	Shade	: Natural shade.
Period of conversion	: Sept. 1951.	Replications	: 2.
		Area of Exptl block	: 65.50 cents.

Mean yield of ripe cherry per plot (actual) in lb. and calculated yield of clean coffee in cwt. per acre of 538 plants.

Year	Description of crop.	Ripe cherry in lb. Clean coffee in cwt. A. Single Stem	B. Multiple stem
1953	Ripe cherry.	121.06	52.69
	Clean coffee.	1.33	0.58
1954	Ripe cherry.	110.30	153.63
	Clean coffee.	1.20	1.61
1955	Ripe cherry.	138.00	105.34
	Clean coffee.	1.51	1.15
1956	Ripe cherry.	312.00	213.5
	Clean coffee.	3.41	2.35
1957	Ripe cherry.	394.00	136.00
	Clean coffee.	4.30	1.49
Mean.	Ripe cherry.	215.07	132.23
	Clean coffee.	2.35	1.44

Note:—1. 5 lb. of ripe cherry has been taken to yield 1 lb. of clean coffee.
2. During March 1957, one of the multiple stems in all the plants under Treatment B was cut down, A new sucker is developing for forming one of the multiple stems in the 2nd cycle.

APPENDIX XXXI

Arabica varietal trial at the Coffee Research sub-station, Chethalli (Coorg)

Locality : Chethalli, Coorg (Mysore State).

Size of plots : 12 X 8-96 plants. Layout : Latin square.

Spacing : 6½' X 6½'. Planted : 1949.

Treatments : 4-
A.—S. 446; B.—S. 795; C.—S. 645; D.—S. 288.

Shade : Natural shade. Area of Exptl. block-1.49 acres.

Yield per acre of ripe cherry in lb and clean coffee in cwt. (calculated)

Year	Dscription of crop.	Yield ripe cherry in lb. & clean coffee in cwt. /acre. S. 446	S. 795	S. 646	S. 288	Mean.	S. E. M.%	Significant or not.	Critical difference	Conclusions.
1952	Ripe cherry	875	255	193	133	364	23.48	Yes	191	A B C D
	Clean coffee	1.30	0.38	0.29	0.20	0.54	—	—	0.43	
1953	Ripe cherry	3746	1897	1366	808	1954	16.22	Yes	1095	A B C D
	Clean coffee	5.57	2.82	2.03	1.20	2.91	—	—	1.63	
1954	Ripe cherry	1541	3402	2478	1498	2230	14.18	Yes	1096	B C A D
	Clean coffee	2.29	5.06	3.69	2.23	3.32	—		1.63	
1955	Ripe cherry	6939	9043	4865	4404	6063		Yes		B A C D
	Clean coffee	8.84	13.46	7.24	6.55	9.02				
1956	Ripe cherry	1997	8551	5821	4259	5157		Yes		B C D A
	Clean coffee	3.00	12.70	8.60	6.30	7.65				
1957	Ripe cherry	9208	10548	9422	8765	9486	—	No	—	B C A D
	Clean coffee	13.70	15.70	14.02	13.04	14.12				

APPENDIX XXXII

Studies on the Essential Requirements of Plant Foods N.P.K. for Coffee in Relation to Improvement In Yield—Manurial Series—Yield Record and Percentage of Floats in the Harvest:

Area of Experimental plot : 76 Cents. Started : in 1937
No. of plants per Sub-plot : 8 x 5 = 40 (up to Jan. '55) Layout : Latin square. Treatments : 5
5 x 4 = 20 (from Jan. '55) Replications : 5.,
Shade : Artificial bamboo slats on pandal Spacing : '5 x 5' (up to Jan. 55)
Guard Row : One row all round the block (from Jan. 55 along the rows 10' and along diagonal 7'.
Annual Rate of Manuring : Nitrogen 60 lb. to the acre in three equal doses.
Phosphoric acid 30 lb. to the acre in two equal doses.
Potash 40 lb. to the acre in two equal doses.

YEAR AND PARTICULARS	Average yield of ripe cherry in lbs. and clean coffee in cwts. calculated to the acre. Percentage of floats in the harvest TREATMENTS A N	B NP	C NK	D NPK	E Control	Standard error as % of gen mean.	Critical difference as P=0.05.	Significant or not.	Conclusions
1956 a) Cherry based on 20 plants	3391	4394	3191	3819	3121	7.70	850.13	YES	B D A C E
1956 (b) Cherry based on 40 plants	6782	8788	6382	7637	6242	7.70	1700	YES	B D A C E
1956 (a) Clean coffee based on 20 plants	5.04	6.99	4.89	5.64	4.71	8.36	1.39	YES	B D A C E
1956 (b Clean coffee based on 40 plants	10.08	13.38	9.78	11.28	9.42	8.36	2.78	YES	B D A C E
1957 (a Cherry based on 20 plants	2406	3395	2166	3038	1632	8.60	689	YES	B D C A E
1957 b) Cherry based on 40 plants	4812	6790	4932	6196	3264	8.60	1378	YES	B D C A E
1957 (a) Clean coffee based on 20 plants	3.93	5.45	3.80	4.78	2.36	8.86	1.11	YES	B D A C E
1957 (b) Clean coffee based on 40 plants	7.86	10.89	7.59	9.58	4.72	8.86	2.22	YES	B D A C E
Average Ripe Cherry for 17 years	1712	2055	1516	2014	1470	4.20	236.0	YES	B D C A E
Average Clean Coffee for 9 years	4.17	4.95	4.13	4.54	3.45	3.92	0.51	YES	B D A C E
1956 Percentage of floats by weight	3.95	4.28	3.38	2.78	3.75	1.96	2.20	NO	B A E C D
1956 Percentage of floats by volume	4.29	4.47	3.67	2.90	3.96	1.97	2.35	NO	B A E C D
1957 Percentage of floats by weight	9.58	11.36	10.19	11.85	11.16	6.62	2.18	NO	D B E C A
1957 Percentage of floats by volume	9.58	11.22	10.22	11.76	10.88	8.02	2.64	NO	D B E C A

APPENDIX XXXIII

N.P.K. Trials with Varying Levels of N.P.K. Fundamental Manurial Experiments in the pH Cisterns:

Yield record and percentage of floats in the harvest.

Area of experimental plot : 0.5 cent
Layout : Latin spuare
No. of plants per sub-plot : One
Spacing : $7\frac{1}{2}$'
Shade : Artificial-coir matting over pandal
Treatments : 6
Replications : 6
Started in 1950

Annual rate of Manuring :

A :	20 lb. Nitrogen,	30 lb. Phosphoric acid,	40 lb. Potash to the acre.
B :	30 „ „	30 „ „	40 „ „
C :	45 „ „	30 „ „	40 „ „
D :	30 „ „	45 „ „	40 „ „
E :	30 „ „	45 „ „	60 „ „
F :	45 „ „	67.5„ „	90 „ „

YEAR AND PARTICULARS	Average yield of ripe cherry and clean coffee in lb. per plot and percentage of floats. TREATMENTS A	B	C	D	E	F	Standard error as % of gen mean.	Critical difference P =0.05	Significant or not	Conclusions
1956 Ripe Cherry	4.07	2.77	4.70	5.23	3.44	5.86	20.67	2.44	YES	F C A E D B
1956 Clean coffee	0.68	0.45	0.78	0.52	0.57	0.95	21.14	0.36	NO	F C A E D B
1957 Ripe Cherry	1.17	0.66	0.57	0.56	0.42	0.65	24.82	0.49	NO	A B F C D E
1957 Clean coffee	0.20	0.11	0.10	0.10	0.07	0.11	24.80	0.08	NO	A B F C D E
Average Ripe Cherry for 4 years	2.19	1.54	1.85	1.37	1.47	2.39	17.14	0.91	NO	F A C B E D
Average Clean Coffee for 4 years	0.36	0.25	0.31	0.23	0.25	0.39	17.26	0.15	NO	F A C B E D
1956 Floats by weight	18.03	18.73	20.26	21.53	21.21	18.26	10.56	6.13	NO	D E C B F A
1956 Floats by volume	19.63	17.97	22.67	22.63	22.87	19.55	10.65	6.57	NO	E C D A F B
1957 Floats by weight	12.9	13.04	12.11	14.42	19.31	15.23	22.86	9.78	NO	E F D B A C
1957 Floats by volume	11.65	9.82	11.00	14.86	17.56	14.53	15.02	5.87	NO	E D F A C B

APPENDIX XXXIV

N. P. K. Trials with varying levels and combinations (Arabica Manurial Experiment at the Coffee Research sub station: Chethalli. Coorg: Yield data 1956—1957.

Area of experimental plot: 2.28 acres.
No. of plants per sub plot:
Gross : 7 × 7 = 49
Nett : 5 × 5 = 25
Variety of coffee : S-446 2nd generation.
Terraced and planted in August 1952.

Layout : Factorial design 4X2X2
Replications : 3
Planted : $6\frac{1}{2}' \times 6\frac{1}{2}'$ square.
Shade : Natural mixed shade
1st manuring-May 1953

Treatments:

Nitrogen at 4 levels No, N1, N2 aud N3.
No = O lb N N1 = 60 lb. N. N2 = 90 lb. N N3 = 120 lb. N per acre.
Phosphoric acid at 2 levels Po and P1.
Po = O lb. P_2O_5 P1 = 30 lb. P_2O_5 per acre.
Potash at 2 levels Ko and K1.
Ko = O lb. K_2O K1 = 40 lb. K_2O per acre.

Treatments.			Yield of cherry in lbs. calculated to single plant. Replications I	II	III	Mean	Yield calculated to the acre.
1	NoPoKo	A	11.8	10.0	15.6	12.5	12868
2	NoPoK1	B	12.5	17.0	13.5	14.3	14754
3	NoP1Ko	C	17.9	15.2	11.4	14.8	15280
4	NoP1K1	D	11.6	14.9	12.2	12.9	13254
5	N1PoKo	E	11.4	17.9	8.6	12.6	13003
6	N1PoK1	F	13.0	14.6	8.6	12.1	12417
7	N1P1Ko	G	14.4	10.4	8.8	11.2	11512
8	N1P1K1	H	17.3	12.1	10.5	13.3	13683
9	N2PoKo	I	11.9	15.4	6.6	11.3	11649
10	N2PoK1	J	11.3	11.8	7.8	10.3	10599
11	N2P1Ko	K	9.3	8.1	12.4	9.9	10205
12	N2P1K1	L	9.4	14.4	8.1	10.6	10993
13	N3PoKo	M	12.2	12.2	7.0	10.5	10764
14	N3PoK1	N	19.4	9.8	8.2	12.5	12855
15	N3P1Ko	O	12.7	14.9	11.4	13.0	13384
16	N3P1K1	P	11.0	12.9	13.8	12.6	12996

Standard error as % of gen. mean.	Critical difference P = 0.05	Significant or not.	Conclusions
14.02	4.92	NO	C B H O D E P A N F I G L M J K

APPENDIX XXXV(a)

Studies on the Effect of Aldrinised Fertilizers on the Yield of Coffee—Coffee Research Station, Balehonnur:

Yield record for 1956—1957.

Area of experimental plot : 0.60 acres. Layout : Randomized block. Treatments : 4 Replications : 6

No. of plants per sub-plot : 6X5 = 30 Spacing : 6'X6' Shade : Natural mixed shade.

Started in 1955

Annual rate of manuring : A: 440 lb. of fertilizer mixture to the acre per year to give 80 lb. N, 45 lb. P205, 60 lb. K20 to be applied in three equal doses during-1) Pre-blossom, 2) Postblossom-Pre-mon soon 3) Post-monsoon.

B: Same as in (A) above + 2.25 lb. of Aldrin.

C: " " + 1.5 " "

D: " " + 1 " "

Treatments	Yield of ripe cherry in lb. per plot. REPLICATIONS 1	2	3	4	5	6	Total	Mean	Calculated yield per acre.	Standard error as % of gen mean.	Critical difference as P = 0.05	Significant or not.	Conclusions
A:	128.61	156.80	139.13	160.34	94.01	126.21	805.10	134.18	5367				
B:	114.82	129.82	134.17	154.44	89.74	145.75	768.74	128.12	5125				
C:	148.19	150.65	151.00	155.89	106.60	108.61	820.84	136.80	5472	4.38	17.80	NO	$\overline{\text{DCAB}}$
D:	128.88	179.44	149.48	139.28	121.55	121.25	839.88	139.98	5599				

APPENDIX XXXV *(b)*

Studies on the Effect of Aldrinised Fertilizers on the Yield of Coffee

Coffee Research Sub-Station—Chethalli :

Yield record for 1956—1957.

Area of experimental plot : 0.60 acres. Layout : Randomized block. Treatments : 4 Replications : 6
No. of plants per sub-plot : 6x5 = 30 Spacing : 6'x6' Shade : Natural mixed shade.
Started 1955

Annual rate of manuring : A : 440 lb. of fertilizer mixture to the acre per year to give 80 lb. N, 45 lb. P205, 60 lb. K20 to be applied in three equal doses during-(1) Pre-blossom, (2) Post-blossom-Pre-monsoon (3) Post-monsoon.

B : Same as in (A) above + 2.25 lb. of Aldrin.

C : „ „ + 1.5 „ „

D : „ „ + 1 „ „

Treatments	Yield of ripe cherry in lbs per plot. REPLICATIONS 1	2	3	4	5	6	Total	Mean	Calculated yield per acre.	Standard error as % of gen. mean.	Critical difference as P =0.05	Significant or not.	Conclusions
A :	103.8	167.8	197.4	153.8	122.8	64.3	809.9	135.0	5399				
B :	80.7	103.8	148.6	257.1	90.0	73.4	753.6	125.6	5024	13.90	61.18	NO	$\overline{\text{D C A B}}$
C :	174.5	112.8	83.8	191.1	171.9	115.0	849.1	141.5	5661				
D :	222.0	217.5	256.7	218.4	105.6	74.4	1094.6	182.4	7298				

APPENDIX XXXVI

Studies on the Application of Nitrogen only in Divided Doses in Relation to Yield of Coffee

Ossoor Manurial Experiments **Yield Record :**

Area of experimental plot : 0.8 acre. Layout : Rondomized block. Treatments : 4 Replications 6

No. of plants per plot : 8x5 = 40 Spacing : 6'x6' Started in June 1956.

Shade : Natural mixed shade.

Annual rate of manuring : A : 80 lb. Nitrogen only to the acre in one single dose.

B : 80 „ „ in two equal doses of 40 lb. each.

C : 80 „ „ in three doses : 30 lb., 20 lb. and 30 lb.

D: Control — No treatment.

Year and Particulars	Average yield of ripe cherry in lb. calculated to the acre. TREATMENTS A	B	C	D	Standard error as % of genl mean.	Critical difference P = 0.05	Significant or not	Conclusions
1956 Ripe Cherry	3318	3342	3106	3217	8.40	821	NO	B A D C
1957 Ripe Cherry	4791	3517	3909	3986	8.19	1000	NO	A D C B
Average for 4 years.	2970	2729	2673	2807	6.50	548	NO	A D B C

APPENDIX XXXVII

Field Manurial Trials in Private Estates on Arabica Coffee

Layout : Randomized split plot. Treatments: Main: 4 Sub : 4 Shade: Natural mixed shade.

No. of plants per sub plot: Gross: 10 x 7 = 70 Nett : 8 x 5 = 40 Started in 1954.

Treatments : Main : A : Nitrogen at 40 lbs. per acre per annum.

B : Nitrogen at 60 lbs. per acre per annum.

C : Nitrogen at 80 lbs. per acre per annum.

D : Nitrogen at 100 lbs. per acre per annum.

Sub-treatments:

N1 = The required quantity of nitrogen applied in two equal doses once in the premonsoon and once in the post-monsoon periods.

N2 = The required quantity of nitrogen applied in three doses ; once in the premonsoon, once in the post-monsoon, and once in the preblossom periods.

NP = The nitrogen relative to the main treatment to be applied in three doses and the phosphoric acid in two doses once in the preblossom and once in the post-monsoon periods.

NPK = The nitrogen relative to the main treatment to be applied in three doses and the phosphoric acid and potash in two doses once in the preblossom and once in the post-monsoon periods.

Phosphoric acid = 30 lbs. P_2O_5 per acre per annum.

Potash = 40 lbs. K_2O per acre per annum.

APPENDIX XXXVII—*(Contd.)*

Field Manurial Trials in Private Estates on Arabica Coffee

Yield in terms of lbs. of ripe cherry per plant. Totals of replications.

YEAR		N1	N2	NP	NPK	Mean of main treatments	Standard error per plot. Main treatments	Standard error per plot. Sub treatments	Critical difference Main treatments	Critical difference Sub treatments	Significant or not Main treatments	Significant or not Sub treatments	Conclusions
				Urvinkhan Estate :		Mudigere Zone :	Mysore :	Spacing :	6'x6'	Repln s :	2		
1956	A:	5.7	5.1	6.3	6.0	2.9							
	B:	6.9	7.5	7.4	5.3	3.4							
	C:	6.2	5.2	8.1	4.8	3.0	1.95	0.88	2.39	0.98	No	No	Main: D B C A
	D:	6.8	9.5	7.5	5.3	3.6							Sub: NP N2 N1 NPK
Mean of sub treatments		3.2	3.4	3.7	2.7								
1957	A:	4.2	9.2	6.1	6.0	3.2							
	B:	6.6	5.4	4.9	5.7	2.8							
	C:	4.5	5.0	6.4	6.5	2.8	2.26	0.96	3.60	1.05	No	No	Main: A D B C
	D:	7.7	5.5	6.7	5.5	3.2							Sub: N2 NP NPK N1
Mean of sub treatments		2.9	3.1	3.0	3.0								
				Bynecool Estate :		Chickmagalur Zone :	Mysore :	Spacing :	6'x6'	Repln s :	3		
1956	A:	16.5	15.4	18.8	18.1	5.7							
	B:	17.6	15.6	17.7	18.9	5.8							
	C:	15.8	14.8	13.0	14.5	4.8	1.52	0.90	1.52	0.76	No	No	Main: B A D C
	D:	16.1	16.7	16.1	16.3	5.4							Sub: NPK NP N1 N2
Mean of sub treatments		5.5	5.2	5.5	5.7								
1957	A:	10.7	13.6	10.7	10.6	3.8							
	B:	14.0	13.3	10.7	11.8	4.1							
	C:	11.2	12.0	8.8	11.8	3.7	0.62	0.52	0.64	0.45	No	Yes	Main: B A D C
	D:	10.0	12.0	12.0	10.8	3.7							Sub: N2 N1 NPK NP
Mean of sub treatments		3.8	4.2	3.5	3.7								

YEAR		N1	N2	NP	NPK	Mean of main treatments	Standard error per plot: Main treatments	Standard error per plot: Sub treatments	Critical difference: Main treatments	Critical difference: Sub treatments	Significant or not: Main treatments	Significant or not: Sub treatments	Conclusions
Togarihankal Estate : Chikmagalur Zone : Mysore : Spacing : 6'x6' Replns. 3													
1956	A	18.2	16.5	17.9	19.2	6.0							
	B	12.9	22.5	23.0	18.5	6.4							
	C	14.1	15.9	19.3	15.9	5.4	0.90	1.32	0.96	1.09	NO	NO	Main : $\overline{\text{B D A C}}$
	D	18.3	19.6	18.6	19.2	6.3							Sub : $\overline{\text{NP N2 NPK N1}}$
Mean of Sub-Treatments.		5.3	6.2	6.6	6.1								
1957	A	13.1	11.8	9.9	12.4	3.9							
	B	6.3	8.8	10.7	9.0	2.9							
	C	8.8	8.4	9.8	11.8	3.2	1.18	0.62	1.18	0.54	NO	NO	Main : $\overline{\text{D A C B}}$
	D	10.5	12.5	12.4	12.4	4.0							Sub : $\overline{\text{NPK NP N2 N1}}$
Mean of Sub-Treatments.		3.2	3.5	3.6	3.8								
Sulgode Estate : Saklespur Zone : Mysore : Spacing : 5'x5' Replns. 3													
1956	A	2.6	2.2	2.8	2.8	0.9							
	B	3.2	2.3	3.6	2.5	1.0							
	C	3.1	3.7	2.8	2.9	1.0	0.33	0.31	1.23	0.28	NO	NO	Main : $\overline{\text{D C B A}}$
	D	2.7	4.9	3.1	4.6	1.3							Sub : $\overline{\text{NPK N2 NP N1}}$
Mean of Sub-Treatments.		1.0	1.1	1.0	1.1								
1957	A	10.4	8.0	9 1	10.3	3.2							
	B	10.3	11.9	13.9	11.0	3.9							
	C	11 3	11.8	15.1	9.5	4.0	1.32	1.32	1.30	1.09	NO	NO	Main : $\overline{\text{C B D A}}$
	D	10.6	10.0	10.3	11.3	3.5							Sub : $\overline{\text{NP N1 NPK N2}}$
Mean of ub-Treatments.		3.6	3.5	4.0	3.5								

APPENDIX XXXVII *(Contd.)*

YEAR		N1	N2	NP	NPK	Mean of main treatments	Standard error per plot: Main treatments	Standard error per plot: Sub treatments	Critical difference: Main treatments	Critical difference: Sub treatments	Significant or not: Main treatments	Significant or not: Sub treatments	Conclusions
Karadibetta Estate : Saklespur Zone : Mysore : Spacing : 6'x6' Replns. 5													
1956	A	7.8	9.5	8.5	8.9	1.7							Main : $\overline{B\ C\ A\ D}$
	B	7.2	11.6	9.9	10.3	2.0							
	C	8.8	9.1	8.4	10.2	1.8	0.94	0.80	0.65	0.51	NO	NO	
	D	8.2	8.2	8.6	7.1	1.6							Sub: $\overline{N2\ NPK\ NP\ N1}$
Mean of sub treatments.		1.6	1.9	1.8	1.8								
1957	A	20.0	21.5	20.9	21.8	4.2							Main : $\overline{C\ D}\ \underline{A\ B}$
	B	22.7	17.4	16.8	26.0	4.1							
	C	22.2	22.8	26.1	27.6	4.9	0.85	0.85	0.58	0.53	YES	YES	
	D	25.1	19.8	23.1	21.8	4.5							Sub: $\overline{NPK\ \underline{N1\ NP}\ N2}$
Mean of sub treatments.		4.5	4.1	4.4	4.9								
Vasambadi Estate Shevaroys Madras Spacing $5\frac{1}{2}$' x $5\frac{1}{2}$' Replns. 3													
1956	A	11.5	11.4	13.6	9.4	3.8							Main : $\overline{D\ B\ A\ C}$
	B	11.2	13.0	11.7	12.1	4.0							
	C	8.5	9.4	10.9	9.8	3.2	1.25	1.11	1.26	0.92	NO	NO	
	D	10.3	11.9	13.1	14.4	4.1							Sub: $\overline{NP\ NPK\ N2\ N1}$
sMean of sub treatments.		3.5	3.8	4.1	3.8								
1957	A	21.0	21.2	28.8	25.7	8.1							Main: $\overline{A\ B\ D\ C}$
	B	25.4	18.6	20.1	26.7	7.6							
	C	19.8	21.1	22.6	21.5	7.0	2.53	0.55	2.52	0.47	NO	NO	
	D	23.6	24.8	19.2	21.1	7.4							Sub: $\overline{NPK\ NP\ N1\ N2}$
Mean of sub treatments.		7.5	7.1	7.6	8.0								

APPENDIX XXXVII—*(Contd.)*

YEAR		N 1	N 2	N P	N P K	Mean of main treat-ments.	Standard error per plot: Main treat-ments.	Standard error per plot: Sub treat-ments.	Critical difference: Main treat-ments.	Critical difference: Sub treat-ments.	Significant or not: Main treat-ments.	Significant or not: Sub treat-ments.	Conclusions
Malambi Estate : North Coorg : Spacing: 6' x 6' Replns. 3													
1956	A	5.6	11.9	12.9	6.4	3.1							
	B	11.7	9.6	9.6	11.1	3.5							
	C	15.2	9.5	14.7	11.9	4.3	1.35	1.39	1.32	1.15	NO	NO	Main: $\overline{D\ C\ B\ A}$
	D	15.7	15.3	14.3	12.1	4.8							Sub: $\overline{NP\ N1\ N2\ NPK}$
Mean of sub treat-ments.		4.0	3.9	4.3	3.5								
1957	A	16.2	18.4	15.9	12.0	5.2							
	B	17.2	15.5	18.4	20.5	6.0							
	C	17.8	15.6	17.3	15.2	5.5	2.29	1.11	2.27	0.93	NO	NO	Main: $\overline{B\ C\ D\ A}$
	D	13.0	17.1	16.2	19.2	5.5							Sub: $\overline{NP\ NPK\ N2\ N1}$
Mean of sub treat-ments.		5.4	5.6	5.7	5.6								
Coffee Research Sub-Station : Chethalli : Spacing : 6' x 6' Replns. 3													
1956	A	5.3	3.8	7.2	3.6	1.7							
	B	5.4	4.1	5.5	4.8	1.7							
	C	6.1	6.3	7.4	4.8	2.1	1.18	0.69	1.18	0.60	NO	NO	Main : $\overline{C\ D\ A\ B}$
	D	7.4	4.3	6.5	4.9	1.9							Sub: $\overline{NP\ N1\ N2\ NPK}$
Mean of sub treat-ments.		2.0	1.5	2.2	1.5								
1957	A	14.4	13.6	18.1	17.5	5.3							
	B	15.0	15.0	15.6	12.7	4.9							
	C	14.1	14.0	13.7	20.7	5.2	1.39	1.21	1.37	1.03	NO	NO	Main: $\overline{D\ A\ C\ B}$
	D	13.0	17.8	16.0	20.6	5.6							Sub: $\overline{NPK\ NP\ N2\ N1}$
Mean of sub treat-ments.		4.7	5.0	5.3	6.0								

APPENDIX XXXVII *(Contd)*

YEAR		N1	N2	NP	NPK	Mean of main treatments.	Standard error per plot: Main treatments.	Standard error per plot: Sub treatments.	Critical difference: Main treatments.	Critical difference: Sub treatments.	Significant or not: Main treatments.	Significant or not: Sub treatments.	Conclusions.
Merthikhan Estate : North Mysore : Spacing : 6' x 6' Replns. 3													
1956	A	15.1	12.5	15.0	11.1	4.5							Main : $\overline{\text{D B A C}}$
	B	15.5	16.0	13.9	16.8	5.2							
	C	12.1	14.4	14.5	10.2	4.3	3.60	1.32	3.60	1.09	NO	NO	
	D	13.5	17.8	15.8	16.8	5.3							Sub : $\overline{\text{N2 NP N1 NPK}}$
Mean of sub treatments.		4.7	5.1	4.9	4.6								
1957	A	15.1	15.8	11.6	18.5	5.1							Main : $\overline{\text{A D C B}}$
	B	11.9	9.9	15.0	11.9	4.1							
	C	15.1	11.8	13.4	15.9	4.7	1.21	1.11	1.22	0.93	NO	NO	
	D	15.7	15.1	15.3	14.4	5.0							Sub : $\overline{\text{NPK N1 NP N2}}$
Mean of sub treatments		4.8	4.4	4.6	5.1								
Maruvahulla Estate : Kotagiri : Nilgiris : Spacing : 6' x 6' Replns. 3.													
1956	A	9.2	5.8	9.0	6.3	2.5							Main : $\overline{\text{C D A B}}$
	B	6.1	8.2	6.0	8.7	2.4							
	C	12.6	11.2	10.3	11.0	3.8	1.35	0.76	1.22	0.66	NO	NO	
	D	7.4	12.4	10.6	8.0	3.2							Sub : $\overline{\text{N2 NP N1 NPK}}$
Mean of sub treatments.		2.9	3.1	3.0	2.8								
1957	A	8.3	9.1	8.6	6.9	2.7							Main : $\overline{\text{C B A D}}$
	B	6.4	8.1	10.2	9.3	2.8							
	C	12.3	11.2	9.5	12.5	3.8	1.56	0.90	1.63	0.75	NO	NO	
	D	7.9	8.3	9.9	6.6	2.7							Sub : $\overline{\text{NP N2 NPK N1}}$
Mean of sub treatments		2.9	3.1	3.2	2.9								

APPENDIX XXXVIII

Robusta Field Manurial Trials in Private Estates: Yield Data 1956-1957.

Treatments: Main: 4 Sub: 4 — Layout: Randomized split plot. — Shade: Natural mixed shade Started in 1955.

No. of plants per sub plot: Gross: 7 x 6 = 42 Nett: 5 x 4 = 20

Treatments: Main: A. Nitrogen at 40 lbs per acre per annum.
B. Nitrogen at 60 lbs per acre per annum.
C. Nitrogen at 80 lbs per acre per annum.
D. Nitrogen at 100 lbs per acre per annum.

Sub-treatments. N1 = The required quantity of nitrogen applied in two equal doses once in the premonsoon, once in the postmonsoon periods.
N2 = The required quantity of Nitrogen applied in three doses; once in the premonsoon, once in the postmonsoon, and once in the preblossom periods.
NP = The Nitrogen relative to the main treatment to be applied in three doses and the Phosphoric acid in two doses once in the preblossom and once in the postmonsoon periods.
NPK = The Nitrogen relative to the main treatment to be applied in three doses and the Phosphoric acid and Potash in two doses once in the preblossom and once in the postmonsoon periods.

Phosphoric acid = 30 lbs P_2O_5 per acre per annum.
Potash = 40 lbs K_2O per acre per annum.

Main Treatments.	Yield** Sub Treatments N1	N2	NP	NPK	Mean	Standard error per plot. Main treatments.	Sub treatments.	Critical difference. Main treatments.	Sub treatments.	Significant or not Main treatments.	Sub treatments.	Conclusions.
Sulgode Estate: Saklespur Zone: Mysore: Spacing: 10′ x 10′ Replns. 3												
A.	28.6	28.0	28.8	30.5	9.7							
B.	18.0	24.5	22.2	29.8	7.9							
C.	37.8	20.5	24.9	28.2	9.3	1.97	2.53	1.97	2.13	NO	NO	Main: D A C B
D.	25.6	37.7	27.6	29.8	10.1							
Mean	9.2	9.2	8.6	9.9								Sub: NPK N2 N1 NP

** Yield of ripe cherry in lbs. calculated to single plant (totals of replications)

APPENDIX XXXVIII *(Contd.)*

Main Treatments.	Sub Treatments N1	N2	NP	NPK	Mean	Standard error per plot Main treatments.	Sub treatments.	Critical difference Main treatments.	Sub treatments.	Significant or not Main treatments.	Sub treatments.	Conclusions
Krishna Estate : Kalpetta Wynaad : Spacing : 9′ x 9′ Replns. 3												
A.	19.3	20.0	20.6	20.5	6.7							Main : A B C D
B.	17.5	17.2	20.0	22.1	6.4							
C.	16.1	18.8	18.6	20.3	6.2	1.04	0.69	1.05	0.58	NO	YES	
D.	18.0	18.1	16.8	18.6	5.9							Sub: NPK NP N2 N1
Mean	5.9	6.2	6.3	6.8								
Pathripara Estate : Kalpetta : Wynaad : Spacing : 9′ x 9′ Replns. 3												
A.	35.6	42.9	41.6	38.7	13.2							Main: B D C A
B.	37.1	55.8	46.6	44.4	15.3							
C.	42.4	40.5	49.4	47.8	15.0	3.50	2.32	3.48	1.96	NO	NO	
D.	46.1	37.3	42.7	55.9	15.2							Sub: NPK NP N2 N1
Mean	13.4	14.7	15.0	15.6								
Chellote Estate : Kalpetta : Wynaad Spacing 10′ x 10′ Replns. 2												
A.	4.9	4.2	4.0	5.6	2.3							Main: B D C A
B.	7.1	9.4	8.8	9.8	4.4							
C.	5.9	6.2	5.8	8.3	3.3	1.26	0.74	1.62	0.65	NO	YES	
D.	6.2	5.7	6.9	9.4	3.5							Sub: NPK NP N2 N1
Mean	3.0	3.2	3.2	4.1								
North Carolina Estate : Kalpetta : Wynaad Spacing : Replns. I & II 10′ x 10′. Repln. III 9′ x 9′ Replns. 3												
A.	25.6	22.1	17.4	28.0	7.8							Main: D C A B
B.	24.9	21.6	20.7	23.1	7.5							
C.	3 .0	18.6	22.6	22.8	7.9	4.33	1.66	4.33	1.40	NO	YES	
D.	24.4	28.9	24.5	38.9	9.7							Sub : NPK N1 N2 NP
Mean	8.8	7.6	7.1	9.4								

APPENDIX XXXIX (a)

Exploratory Trial on the Effect of Foliar Applications of Plant Foods to Coffee in Relation to Growth and Yield.

Yield Record For 1956-1957.

Layout: Simple randomized. Treatments: 10 Replications: 3

Single plant constitutes a sub-plot.

Treatments.

A. 20 lbs. Nitrogen per acre — sprayed as urea solution (N1)
B. 40 ;, ,, ,, ,, ,, (N2)
C. As in treatment A+15 lbs. P_2O_5 sprayed as Superphosphate dispersion (N1P1)
D. As in treatment B+30 lbs. P_2O_5 applied as above (N2P2)
E. As in treatment A+20 lbs. K_2O sprayed as muriate of of potash solution (N1K1)
F. As in treatment B+40 lbs. K_2O applied as above (N2K2)
G. As in treatment C+20 lbs. K_2O applied as obove (N1P1K1)
H. As in treatment D+40 lbs. K_2O applied as above (N2P2K2)
I. No treatment — Control (NoPoKo)
J. Plain water used for the above solutions. (NoPoKo)

Replications.	Yield of ripe cherry per plot (in ozs) TREATMENTS A	B	C	D	E	F	G	H	I	J
I	40	94	51	113	74	43	43	21	92	110
II	96	116	66	130	88	41	34	51	152	48
III	80	38	108	82	176	68	119	121	118	95
Mean:	72.0	82.7	75.0	108.3	112.7	50.7	65.3	64.3	120.7	84.3
	Yield of clean coffee per plot in ozs.									
I	8	17	10	22	13	8	9	4	16	20
II	17	24	12	26	16	8	7	11	29	9
III	14	7	20	14	32	12	24	23	22	17
Mean:	13.0	16.0	14.0	20.7	20.3	9.3	13.3	12.7	22.3	15.3

	Standard error as % of gen. mean.	Critical difference P = 0.05	Significant or not.
Cherry	24.50	60.84	NO
Clean Coffee	25.61	11.91	NO

Conclusions :

Ripe Cherry I E D J B C A G H F

Clean Coffee I D E B J C G A H F

APPENDIX XXXIX—(*b*)

Exploratory Trial on the Effect of Foliar Applications of Plant Foods to Coffee in Relation to Growth and Yield—Blossom to Berry Observations 1956—1957.

Details of the experiment given in appendix XXXIX (a)

Replications	Percentage of fruit set in each plot TREATMENTS									
	A	B	C	D	E	F	G	H	I	J
I Replication	51.1	39.8	35.9	17.2	34·1	29.8	23.0	21.7	45.4	30.7
II „	34.1	34.5	42.3	27.7	27.9	48.2	26.4	29.6	46.3	38.6
III „	46.7	13.7	22.5	24.5	28.6	41.7	40.7	35.2	46.1	22.7
Mean	44.0	29.3	33.6	23.1	30.2	39.9	30.0	28.8	45.9	30.7

Standard error as % of gen. mean.	Critical difference P=0.05	Significant or not.	Conclusions
11.76	14.74	NO	IAFCJEGBHD

APPENDIX XL.

N.P.K. Trials with varying Levels and Combinations to find out the Essential Requirements of N.P.K. for good Growth of Arabica Seedlings

Treatments : Main 27 - 3 levels each of N, P & K in all possible combinations.
Sub-treatments : 2 x 2 - 4 in each main treatment due to variation in soil medium.
Treatments : Gross= 108.
Plot size : 6 x 6= 36 Seedlings are planted 9" x 9" for each main treatment in one box with 3 x 3= 9 Seedlings for each of the sub-treatments in each quarter of one box.
Replications : 3 Layout : Randomized.

	Main treatments combinations.	Symbol		Main treatments combinations.	Symbol
1.	NoPoKo	H	15.	$N_1P_2K_1$	E
2.	NoP_1Ko	H	16.	N_1PoK_2	O
3.	NoP_2Ko	J	17.	$N_1P_1K_2$	K
4.	$NoPoK_1$	X	18.	$N_1P_2K_2$	N
5.	NoP_1K_1	P	19.	N_2PoKo	T
6.	NoP_2K_1	G	20.	N_2P_1Ko	D
7.	$NoPoK_2$	L	21.	N_2P_2Ko	Y
8.	NoP_1K_2	A	22.	N_2PoK_1	I
9.	NoP_2K_2	Z	23.	$N_2P_1K_1$	R
10.	N_1PoKo	V	24.	$N_2P_2K_1$	C
11.	N_1P_1Ko	F	25.	N_2PoK_2	U
12.	N_1P_2Ko	S	26.	$N_2P_1K_2$	M
13.	N_1PoK_1	Q	27.	$N_2P_2K_2$	W
14.	$N_1P_1K_1$	B			

Where No = Nil Nitrogen.
N_1 = 0.5 gms of urea (46% N) per plant per application (12 lb. nitrogen for 1,200 seedlings in 20 weekly applications).
N_2 = 1 gm. of urea (46% N) applied as above. (24 lb. nitrogen for 1,200 seedlings .
Po = Nil Phosphoric acid.
P_1 = 0.5 gms of Hyper-phosphate Reno (30% P_2O_5) per plant per application (7.5 lb. Phosphoric acid for 1200 seedlings in 20 weekly applications).
P_2 = 1.0 gm. of Hyper-phosphate Reno applied as above. (15 lb. P_2O_5 for 1200 seedlings).
Ko = Nil Potash.
K_1 = 0.4 gms of Muriate of potash 60% K_2O) per plant per application (12 lb. Potash for 1200 seedlings in 20 weekly applications).
K_2 = 0.8 gms of Muriate of Potash applied as above. (24 lb. Potash for 1200 seedlings).

Sub-treatments :

Each of the main treatments is imposed on :) Plants growing in ordinary top soil and (2) plants growing in prepared soil made up of two parts of top soil from jungle, one part of compost (made of coffee fruits skin, urea and rock-phosphate) and one part of river sand.

One half of each of the above two types of soils are limed at the rate of 1 lb. of agricultural lime for every thousand pounds of soil - once before planting the seedlings and later again if necessary.

This results in the following four sub-treatments.

1. Main Treatment in prepared soil, unlimed.
2. Main Treatment in prepared soil, limed.
3. Main Treatment in ordinary soil, unlimed.
4. Main Treatment in ordinary soil, limed.

APPENDIX XL. *(a)*

N.P.K. Trials with Varying Levels and Combinations to find out the Essential Requirements of N.P.K. for Good Growth of Arabica Seedlings: Increase in Height of Seedlings:

Main Treatments	Symbol	Total of three replications Sub Treatments 1	2	3	4	Mean
$N_0P_1K_2$	A	201.5	199.7	153.7	148.0	58.6
$N_1P_1K_1$	B	195.9	190.0	121.0	127.3	52.8
$N_2P_2K_1$	C	160.0	182.4	101.2	108.8	46.0
$N_2P_1K_0$	D	151.0	177.6	89.1	111.0	44.1
$N_1P_2K_1$	E	198.6	198.5	144.3	146.6	57.3
$N_1P_1K_0$	F	196.9	192.4	138.2	167.5	57.9
$N_0P_2K_1$	G	215.0	220.2	146.3	153.3	61.2
$N_0P_0K_0$	H	204.4	209.1	152.9	136.6	58.6
$N_2P_0K_1$	I	172.9	189.9	83.4	87.5	45.3
$N_0P_2K_0$	J	238.8	224.2	154.6	151.1	64.1
$N_1P_1K_2$	K	179.9	194.7	145.5	131.8	54.3
$N_0P_0K_2$	L	184.9	204.5	152.1	139.9	56.8
$N_2P_1K_2$	M	170.1	194.3	98.1	108.4	47.6
$N_1P_2K_2$	N	143.4	186.6	127.5	112.6	47.5
$N_1P_0K_2$	O	195.9	174.3	123.6	122.5	51.4
$N_0P_1K_1$	P	196.9	213.8	153.5	132.4	58.1
$N_1P_0K_1$	Q	185.2	212.5	144.1	116.0	54.8
$N_2P_1K_1$	R	194.5	180.9	99.5	122.5	49.8
$N_1P_2K_0$	S	193.0	195.1	153.8	148.1	57.5
$N_2P_0K_0$	T	173.8	177.5	85.2	89.4	43.8
$N_2P_0K_2$	U	169.7	185.8	69.7	80.4	42.1
$N_1P_0K_0$	V	205.4	216.0	140.1	142.9	58.7
$N_2P_2K_2$	W	152.0	143.5	76.0	124.4	41.3
$N_0P_0K_1$	X	208.2	208.0	148.9	153.9	59.9
$N_2P_2K_0$	Y	198.4	208.9	136.9	117.7	55.2
$N_0P_2K_2$	Z	206.2	200.3	154.5	151.6	59.4
$N_0P_1K_0$	II	196.9	215.1	149.3	162.9	60.4
Mean		62.8	65.4	42.5	43.3	

Treatments.	Standard error per plot	Critical difference P = 0.05	P = 0.01	Significant or not P = 0.05	P = 0.01
Main	9.51	7.60	9.95	YES	YES
Sub	7.05	2.17	2.85	YES	YES

APPENDIX XL *(a)*

Conclusions :—Main-as P =0.05

J G II X Z V H A P F S E L Y Q K B O R M N C I D T U W

P= 0.01

J G II X Z V H A P F S E L Y Q K B O R M N C I D T U W

Sub Treatments : as P = 0.05 2 1 4 3

as P = 0.01 2 1 4 3

APPENDIX XL (*b*)

N.P.K. Trials with varying Levels and Combinations to find out the Essential Requirements of N P,K. for Good Growth of Arabica Seedlings: Number of Primaries in each Seedling.

Main Treatments	Symbol	Total of three replications Sub-treatments 1	2	3	4	Mean
NoP1K2	A	39	33	28	21	10.1
N1P1K1	B	32	35	19	20	8.8
N2P2K1	C	32	31	18	19	8.3
N2P1Ko	D	23	32	15	14	7.0
N1P2K1	E	36	32	25	22	9.6
N1P1Ko	F	31	28	18	23	8.6
NoP2K1	G	33	41	21	23	9.8
NoPoKo	H	33	34	23	19	9 1
N2PoK1	I	34	38	12	8	7.7
NoP2Ko	J	41	42	23	19	10 4
N1P1K2	K	32	32	26	18	9.0
NoPoK2	L	31	37	22	24	9.5
N2P1K2	M	31	41	14	20	8.8
N1P2K2	N	28	32	23	14	8.1
N1PoK2	O	36	31	17	20	8.7
NoP1K1	P	32	33	19	17	8.4
N1PoK1	Q	30	31	26	15	8.5
N2P1K1	R	33	34	13	19	8.3
N1P2Ko	S	30	31	28	25	9.5
N2PoKo	T	31	35	12	11	7.4
N2PoK2	U	31	36	11	9	7.3
N1PoKo	V	36	33	21	20	9.2
N2P2K2	W	28	35	12	22	8.1
NoPoK1	X	32	33	17	21	8.6
N2P2Ko	Y	32	36	26	23	9.8
NoP2K2	Z	34	33	26	22	9.6
NoP1Ko	$\bar{n}$	33	35	20	24	9.4
Mean		10.8	11.4	6.6	6.3	

Treatments	Standard error per plot	Critical difference P = 0.05	P = 0.01	Significant or not P = 0.05	P = 0.01
Main	2.32	1.86	2.45	NO	NO
Sub	2.13	0.65	0.86	YES	YES

Conclusions:

Main as P = 0.05 $\overline{\text{J A G Y Z E L S } \bar{n} \text{ V H K B M O X F Q P C R W N I T U D}}$

P = 0.01 $\overline{\text{J A G Y Z E L S } \bar{n} \text{ V H K B M O X F Q P C R W N I T U D}}$

Sub Treatments: P = 0.05 $\overline{2\ 1}$ $\underline{3\ 4}$

P = 0.01 $\overline{2\ 1}$ $\underline{3\ 4}$

APPENDIX XL (c)

N. P. K. Trials with varying Levels and Combinations to find out the Essential Requirements of N. P. K. for good Growth of Arabica Seedlings : Increase in the number of Leaves in each Seedling.

Main Treatments	Symbol	Total of three replications Sub-treatments 1	2	3	4	Mean
NoP1K2	A	232	252	172	120	64.7
N1P1K1	B	235	267	124	114	61.7
N2P2K1	C	238	244	105	106	57.8
N2P1Ko	D	154	219	80	90	45.3
N1P2K1	E	257	244	179	141	68.4
N1P1Ko	F	258	207	122	138	60.4
NoP2K1	G	245	308	146	149	70.7
NoPoKo	H	241	247	155	129	64.3
N2PoK1	I	255	276	78	53	55.2
NoP2Ko	J	323	362	173	112	80.8
N1P1K2	K	238	252	163	101	62.8
NoPoK2	L	219	283	147	139	65.7
N2P1K2	M	237	258	71	112	56.5
N1P2K2	N	194	228	156	92	55.8
N1PoK2	O	264	220	105	130	59.9
NoP1K1	P	252	235	116	102	58.8
N1PoK1	Q	223	231	161	99	59.5
N2P1K1	R	247	279	75	115	59.7
N1P2Ko	S	214	226	173	169	65.2
N2PoKo	T	238	248	38	63	48.9
N2PoK2	U	224	248	53	55	48.3
N1PoKo	V	279	298	134	136	70.6
N2P2K2	W	201	244	66	122	52.8
NoPoK1	X	259	251	102	148	63.3
N2P2Ko	Y	244	261	153	124	65.2
NoP2K2	Z	248	250	186	174	71.5
NoP1Ko	$\bar{\Pi}$	242	256	128	153	64.9
Mean		79.8	85.1	41.5	39.3	

Treatments.	Standard error per plot.	Critical difference. P = 0.05	P = 0.01	Significant or not P = 0.05	P = 0.01
Main	20.13	16.09	21.12	YES	No
Sub	17.14	5.28	6.92	YES	YES

Conclusions :

Main as P= 0.05 J Z G V E L S Y $\bar{\Pi}$ A H X K B F O R Q P C M N I W T U D

P= 0.01 J Z G V E L S Y $\bar{\Pi}$ A H X K B F O R Q P C M N I H T U D

Sub Treatments as P= 0.05 2 1 3 4

P= 0.01 2 1 3 4

APPENDIX (XLI) (a)

Studies on Fruit Set in Coffee—Trials with Duraset—20-W on Arabica

Yield Record—1956—1957.

Layout : Simple randomized. Treatments : 9 x 3= 27
Single plant constitutes a sub-plot. Replications : 3

Treatments :

1. Duraset 20-W ½ lb. in 100 gallons of Water A
2. „ 1 „ „ „ „ B
3. „ 2 „ „ „ „ C

} Solution sprayed to give full coverage of plants.

4. „ 0.13 lb. in 100 lbs. Talc. D
5. „ 0.26 „ „ E
6. „ 0.52 „ „ F

} Dusted to give full coverage of plants.

7. Plain water used for making above solution sprayed G
8. Plain Talc. used for making above dusts, dusted H
9. Control—no treatment I

Time of application : One set of the above treatments given before blossom.
One set on the blossom and
One set after petal fall.

Replications	Yield of ripe cherry in ozs. per plot TREATMENTS A	B	C	D	E	F	G	H	I
				1st Set before Blossom					
I	50	22	24	46	58	52	102	46	58
II	28	34	44	50	30	74	82	22	36
III	78	20	74	26	54	52	74	26	76
Mean	52.0	25.3	47.3	40.7	47.3	59.3	86.0	31.3	56.7
				2nd Set on the Bloossom :					
I	30	24	26	38	64	42	58	34	62
II	10	60	62	56	46	32	16	50	38
III	58	18	106	68	18	84	138	48	46
Mean	32.7	34.0	64.7	54.0	42.7	52.7	70.7	44.0	48.7
				3rd Set after Petal Fall					
I	36	60	36	88	72	22	26	26	48
II	84	54	42	52	18	52	58	20	40
III	126	18	38	58	74	56	88	34	20
Mean	82.0	44.0	38.7	66.0	54.7	43.3	57.3	26.7	36.0

	Standard error as % of general mean.	Critical difference. P = 0.05	Significant or not.	Conclusions
I Set	20.43	30.35	YES	G F I A C E D H B
II Set	33.77	49.95	NO	G C D F I H E B A
III Set	29.43	43.98	NO	A D G E B F I C H

APPENDIX XLI (*b*)

Studies on Fruit set in Coffee-Trials with Duraset-20W on Robusta :

Yield Record–1956—1957.

Details of the experiment-(same as in Arabica)

Replications	Yield of ripe cherry in ozs per plot TREATMENTS A	B	C	D	E	F	G	H	I
1st Set before blossom									
I	74	64	24	20	28	76	56	16	4
II	16	24	4	8	72	8	7	10	9
III	10	6	6	8	120	56	34	9	24
Mean	33.3	31.3	11.3	12.0	73.3	46.7	32.3	11.7	12.3
2nd Set on the Blossom									
I	60	36	36	12	40	100	136	22	26
II	16	20	28	6	8	24	28	56	5
III	36	5	64	16	16	34	2	48	12
Mean	37.3	20.3	42.7	11.3	21.3	52.7	55.3	42.0	14.3
3rd Set after petal fall									
I	64	64	32	48	8	8	92	22	20
II	32	8	26	30	52	16	20	10	48
III	32	8	10	48	10	24	16	19	8
Mean	42.7	26.7	22.7	42.0	23.3	16.0	42.7	17.0	25.3

		Standard error as % of general mean	Critical difference P = 0.05	Significant or not	Conclusions
I	Set	50.19	44.14	NO	EFAGBIDHC
II	Set	48.14	47.78	NO	GFCHAEBID
III	Set	42.93	36.93	NO	AGDBIECHF

APPENDIX XLIII

Exploratory Trial on the Effect of Foliar Application of Plant Foods to Coffee in Relation to Growth and Yield:

Percentage of Total Nitrogen in Leaf Samples collected in May 1956.

(Values on moisture-free basis.)

TREATMENTS			MID-RIBS			LEAF BLADES			BRANCH TIPS		
			Before treatment	After 24 hrs	After 48 hrs	Before treatment	After 24 hrs	After 48 hrs	Before treatment	After 24 hrs	After 48 hrs
1. N1	(20 lb. Nitrogen)	A	1.988	1.813	1.963	2.702	3.123	2.612	3.730	3.458	3.141
2. N2	(40 lb. Nitrogen)	B	1.813	1.752	1.970	2.612	3.065	3.052	2.951	3.475	4.073
3. N1P1	(20 lb. N + 15 lb. P_2O_5)	C	1.798	1.627	1.887	2.764	2.593	2.627	3.361	4.140	3.544
4. N2P2	(40 lb. N + 30 lb. P_2O_5)	D	1.808	1.862	1.797	2.736	3.093	2.847	3.313	4.268	3.789
5. N1K1	(20 lb. N + 20 lb. K_2O)	E	2.020	1.989	1.795	3.226	2.812	2.897	3.315	4.356	3.397
6. N2K2	(40 lb. N + 40 lb. K_2O)	F	2.195	2.198	2.065	3.064	3.069	2.995	4.127	3.637	3.849
7. N1P1K1	(20 lb. N + 15 lb. P_2O_5 + 20 lb. K_2O)	G	1.924	1.847	1.976	3.045	2.882	3.171	2.927	3.443	3.443
8. N2P2K2	(40 lb. N + 30 lb. P_2O_5 + 40 lb. K_2O)	H	1.794	1.803	2.060	2.759	3.321	2.824	3.216	3.519	3.524
9. Control	(no treatment)	I	2.120	1.815	2.099	2.600	2.633	2.839	4.171	3.706	3.650
10. Plain water		J	1.837	1.641	1.471	2.730	2.934	3.106	4.109	3.421	3.449

APPENDIX XLIV

Exploratory Trial on the Effect of Foliar Applications of Plant Foods to Coffee in Relation to Growth and Yield.

Percentage of Total Nitrogen in leaf Samples collected in May 1957.

(Values on moisture free basis)

TREATMENTS		Average of three replications Young leaves							Average of three replications Old leaves						
		Before treatment	After 24 hrs.	% increase after 24 hrs.	After 48 hrs.	% increase after 48 hrs.	After 96 hrs.	% increase after 96 hrs.	Before treatment	After 24 hrs.	% increase after 24 hrs.	After 48 hrs.	% increase after 48 hrs.	After 96 hrs.	% increase after 96 hrs
1. N1	A	3.33	4.01	20.4	3.55	6.4	3.68	10.4	3.08	3.40	10.2	3.59	16.5	3.57	15.7
2. N2	B	4.01	4.44	10.5	5.02	25.0	3.91	-2.6	2.91	3.69	26.7	3.39	16.4	4.03	38.4
3. N1P1	C	4.29	4.68	9.2	4.51	5.2	4.23	-0.1	3.50	3.90	11.4	3.63	3.8	3.84	9.8
4. N2P2	D	3.75	4.00	6.6	4.09	9.1	4.16	11.0	2.66	3.23	21.3	3.66	37.6	3.33	25.4
5. N1K1	E	3.85	3.94	2.5	3.83	-0.3	3.85	0.1	2.34	2.97	26.9	3.00	27.9	3.32	42.0
6. N2K2	F	3.91	3.92	0.2	4.46	13.9	4.27	9.1	3.36	3.50	4.2	3.85	14.7	3.92	16.8
7. N1P1K1	G	3.72	3.92	5.2	3.83	4.3	4.09	9.9	2.77	3.56	28.8	3.31	19.8	3.58	29.4
8. N2P2K2	H	3.71	3.89	4.9	3.69	-0.4	3.87	4.3	3.17	3.98	25.5	3.88	22.6	3.51	10.8
9. Control	I	3.27	3.83	17.3	3.89	19.1	3.75	14.7	2.84	3.24	14.1	3.15	11.0	3.18	11.9
10. Plain water	J	3.93	4.16	5.9	4.10	4.4	4.35	10.8	2.76	4.24	53.9	3.45	24.8	3.36	21.7

APPENDIX XLV

Studies on the loss of Nitrogen from mixtures of Ammonium Sulphate and Mineral Phosphates.

Nitrogen expressed on moisture free basis. Average of duplicate values.

Description of Samples.	Initial Set		After one week		After two weeks		After three weeks		After four weeks		After five weeks		After six weeks		Total loss of N2 at the end of 6 weeks %
	Moisture %	Nitrogen %	Moisture %	Nitrogen %	Moisture %	Nitrogen %	Moisture %	Nitrogen %	Moisture %	Nitrogen %	Moisture %	Nitrogen %	Moisture %	Nitrogen %	
1. Rockphosphate + Ammonium sulphate mixture 1:1 ratio by weight	1.91	10.37	1.66	10.35	1.47	10.34	1.54	10.32	1.10	10.27	1.67	10.13	1.44	10.11	2.507
2. do 1:2 ratio by weight	1.31	13.71	0.81	13.59	0.77	13.58	0.81	13.55	0.95	13.51	1.41	13.46	0.82	13.38	2.407
3. do 1:3 ratio by weight	1.11	16.05	0.77	15.88	0.50	15.85	0.68	15.77	0.56	15.75	0.95	15.74	0.59	15.69	2.242
4. do 1:4 ratio by weight	1.08	16.50	0.61	16.48	0.42	16.45	0.38	16.42	0.38	16.38	1.02	16.36	0.60	16.34	0.969
5. Hyper phosphate + Ammonium sulphate mixture 1:1 ratio by weight	1.71	11.02	1.64	10.91	1.62	10.85	2.29	10.30	1.91	10.26	3.01	9.77	1.86	9.71	11.89
6. do 1:2 ratio by weight	1.41	14.24	1.13	13.94	1.16	13.89	1.36	13.57	1.43	13.46	2.50	13.27	1.52	13.20	7.303
7. do 1:3 ratio by weight	1.12	16.05	0.89	15.96	0.84	15.90	0.88	15.86	1.11	15.79	1.62	15.63	0.94	15.58	2.928
8. do 1:4 ratio by weight	1.34	17.22	0.63	17.09	0.47	16.96	0.76	16.77	0.84	16.62	1.27	16.44	0.83	16.33	5.168

APPENDIX XLVI (a)

Progressive Increase in the Precentage of Moisture in Buds Advancing to Blossoms : Rubber Area (Selections)

Treatments.	Average percentage of moisture								
	2 days after treatment	* % increase in moisture	4 days after treatment	% increase in moisture	6 days after treatment	% increase in moisture	8 days after treatment (day of blossoms) the 9th day	% increase in moisture	Average % of buds advanced to blossoms
O	59.71	...	58.46	...	60.02	...	58.67	...	...
I	60.35	...	62.71	4.52	65.30	8.83	66.61	11.02	...
II	71.68	2.22	77.06	28.43	84.05	40.08	86.08	43.47	67.88
III	74.67	24.45	78.88	1.47	84.62	41.03	86.00	43.33	92.11
17-Acre 1952 Clearing (Kents)									
O	58.16	...	50.20	...	59.22	...	58.03	...	...
I	61.02	...	49.44	...	74.52	24.20	76.23	27.05	12.67
II	63.81	6.35	53.55	...	80.92	34.87	80.71	34.52	40.87
III	68.36	13.93	57.09	...	83.77	39.62	85.88	43.13	80.71

* An average figure 60.00 is taken as the % of moisture in the buds on the day of application of treatment for calculating the % increase in moisture.

APPENDIX XLVI (b)

Progressive Increase in Weight of Buds Advancing to Blossoms:

Rubber Area (Selections)

Treatments	Average weight of 20 buds (mgs.) Day of application of treatment	2 days after treatment	% increase in weight	4 days after treatment	% increase in weight	6 days after treatment	% increase in weight	8 days after treatment (day of blossom) on 9th day	% increase in weight
0	0.23279	0·23280	...	0.22663	...	0.23626	...	0 23414	...
I	0.22502	0·22545	...	0.24266	7·84	0.29206	29.79	0·33750	40.70
II	0.23290	0.34185	46.69	0·74332	219 15	1.39607	499.42	2·12817	814.31
III	0 23276	0.41665	79 00	0·96095	312·85	1.46028	527 37	2·30233	889.14
				17-Acre 1952 Clearing Kents.					
0	0.19086	0.18396	...	0.19754	...	0.18532	...	0·19009	...
I	0·25688	0.25698	...	0 45835	78.43	0.76126	196·35	0.95540	271.92
II	0.22904	0·22926	...	0 48632	112.32	0.86820	279.06	1.08363	373.12
III	0·25642	0.32405	26.37	0·64284	150·70	1.07054	317.49	1 75646	584.99

Treatments : 0—Control—No treatment.

I—Spraying water (12 gallons each day on two successive days) on the bush only, leading the drip water away to prevent it from soaking into the soil under the bush.

II—Same qnty. of water sprayed and the drip water allowed to soak into the soil under the bush.

III—Same qnty. of water applied on to the ground and allowed to soak in

APPENDIX XLVII

Analysis of Leachates from the Sub-Soil Drains of the New Manurial Series Plot 1956–1957

Drain No.	Total flow during the year Imp. gallons	Plant food lost N_2 Average loss per Imp. gallon (mgms)	N_2 Total loss (gms)	P_2O_5 Average loss per Imp. gallon (mgms)	P_2O_5 Total loss (gms)	K_2O Average loss per Imp. gallon (mgms)	K_2O Total loss (gms)
1	48552	19.00	922.49	0.036	1.75	31.10	1509.97
2	55728	22.00	1226.02	0.014	0.78	31.30	1744.29
3	35280	23.00	811.44	0.017	0.60	30.60	1079.57
4	12312	21.00	258.55	0.061	0.75	24.40	300.41
5	10030	23.00	230.69	0.036	0.36	16.20	162.49
	161902 Imp. gallons		3449.19 gms or 7.61 lbs.		4.24 gms		4796.73 gms or 10.57 lbs.

APPENDIX XLVIII

Insecticidal control of Coffee Stem Borer (**Xylotrechus quadripes** Chev.)

Locality : C.R Station, Balehonnur—E. 1 Block. Started ; April 1953.
Layout : Randomized. Plot size : 5 rows of 16 plants—80 plants
Replications : 4 Treatments : 9 Total area under Experiment 2 91 acres

TREATMENTS	1953—1954			1954—1955			1955—1956			1956—1957		
	No. of healthy plants (Initial)	No. borer infested plants removed	% age in festation	No. of healthy plants (initial)	No. borer infested plants removed	% age infestation	No. of healthy plants (initial)	No borer infested plants removed	% age infestation	No. of healthy plants (Initial)	No. borer infested plants removed	% age infestation
A. Control—no treatment	278	17	6.06	259	8	3.1	276	16	5.8	272		1.47
B. Hexidol - 950, 1% ac.	295	11	3.90	290	8	2.8	312	2	0.6	307	2	0.65
C. Lindane W.P. 2% ac.	288	22	7 50	289	6	2.1	254	5	2.0	251	4	1.55
D. G—1250 1% ac.	288	12	4.24	279	5	1.8	261	9	3.4	259	5	1.93
E. Inexite W.P. 0.03% ac.	277	8	3.02	279	7	2.5	286	2	0.7	286	2	0.70
F. Inexite Dust 20% 1:1 ash	287	17	5 79	270	17	6.3	297	13	4.4	290	9	3.10
G. Folidol E—605 Con. 0.37% ac.	310	14	4.42	302	20	6.6	283	7	2.5	278	4	1.46
H. Folidol E—605 W.P. 0.11% Con. ac.	262	24	8.93	241	22	9.1	280	8	2.9	275	2	0.73
I. Gammexane Emulsion Con. 0.15% ac.	318	13	4 05	312	6	1.9	284	5	1.9	282	6	2.0

APPENDIX XLIX

Borer incidence in the Experimental plot

(Experiment No. I1I, Shegode Estate)

Layout : Randomized

Replications : Four

Treatments : 11

Total area under Fxpt. : 3 acres

Started : October 1956.

Plot size : 4 rows of 25 plants.

TREATMENTS	Initial No. of plants	No. of borer infested plants	% age of infestation
A Control no treatment	295	8	2.7
B B.H.C. 50 % W.P 1% 3 applications a year	319	5	1.6
C Dieldrin W.P. 0.25% 2 applications/year	268	3	1.1
D Dieldrin W.P. 0.25% 3 do	282	3	1.1
E do 0 125% 2 do	315	7	2.2
F do 0.125% 3 do	316	13	4.0
G Dieldrex Emuln. 0.25% 2 applications a year	335	4	1.2
H do 0.25% 3 do	305	2	0.7
I do 0.125% 2 do	304	8	2.6
J do 0.125% 3 do	302	3	1.0
K Chlordane 0.09% 3 applications a year	308	4	1.3

APPENDIX L—(a)

Spray experiment to compare the efficacy of different strengths of Bordeaux mixture

Locality: Crawford area, Coffee Research Station, Balehonnur — Started in June 1951

Treatments: 4 — Replications: 4 — Layout: Randomized

Comparative effective percentage of leaf survival

TREATMENTS	Effective percentage of leaf survival from start of experiment									
	Sept. 1952	Feb. 1953	Sept. 1953	Feb. 1954	Sept. 1954	Feb. 1955	Sept. 1955	Feb. 1956	Sept. 1956	Feb. 1957
A Bordeaux — 2:2:40	49.81	39.88	58.76	68.92	41.52	59.75	61.69	4 .55	50.74	42.70
B Bordeaux — 1½:1½:40	53.89	38.00	56.42	46.88	45.00	57.10	54.78	38.75	43.26	40.00
C Bordeaux — 1:1:40	50.72	44.38	62.10	54.36	34.54	49.05	53.46	36.95	39.16	37.10
D Parry's Bye-product 2½:2½:40	49.29	31.88	65.70	64.14	This treatment discontinued.					
General mean	50.91	38.54	60.75	58.58	40.35	55.30	56.64	39 08	44.39	38.93
S.E.M.	...	...	...	...	...	2.79	3 35	2.23	1.66	2.63
Significance	No.	No.	No.	No.	No.	Yes	No.	No.	Yes**	No.
Critical difference	...	...	...	...	...	9.14	...	...	5.43	...
Conclusions						A B C			A B C	

APPENDX L (b)

Spray experiment to compare the efficiacy of different strengths of Bordeaux mixture

Locality : Crawford Area, C. R. Station, Balehonnur
Started in June 1951 — Replications : 4
Treatments : 4 — Layout—Randomized.

A Bordeaux 2 : 2 : 40
B do 1½ : 1½ : 40
C do 1 : 1 : 40
D Parry's bye-product 2½ : 2½ : 40

Yield of ripe cherry in lb. per acre

Treatment	1951—52	1952—53	1953—54	1954—55	1955—56	1956—5
A	3467	444	3562	6247	2929	4355
B	3083	447	4969	6029	2389	4227
C	3041	411	4485	6011	2089	3684
D	2906	550	4626	This treatment discontinued		
Gen. Mean	3124.3	463	4410.5	6095	2469	4089
S. E. M.	...	32.4	...	...	337	693
Significance	No.	Yes	No.	No	No	No
Crit. Diff.	...	111.8	...	...	...	...
Conclusions	...	D B A C				

APPENDIX LI

Spray experiment to find out the efficacy of adding detergents, wetters, spreaders and adhesives to Bordeaux mixture
Locality : 'Q' Block, C R Station, Balehonnur. — Layout : Randomized
Replications : 4 — Started : May 1954
Treatments : 8

Treatments	E. P. L. S. Feb. 1956	E. P. L. S. Sep. 1956	E. P. L. S. Feb. 1957	Yld. ripe cherry in lb./acre 1955-56	Yld. ripe cherry in lb./acre 1956-57
A Bordeaux mixture 2 : 2 : 40	47.55	42.36	42.90	2685	6661
B do +1½ oz. Teepol in 40 gal. mixture	43.15	42.80	37.65	2305	7203
C do +6 oz. Stanvac detergents in 40 gal.	47.55	46.50	44.95	1894	8944
D do +7½ oz. Corvus oil do	44.05	46.90	30.50	2053	8666
E do +10 oz. Arkotin do	This treatment discontinued				
F do +1½ oz. Lissapol N do	49.75	43.46	45.75	1644	8307
G do +1 oz. Agral L.N. do	48.45	41.30	54.65	1839	8496
H do +1.6 oz. Adhesive YF 3198 in 40 gallons	48.20	41.26	46.05	***	***
General mean	46.96	43.51	44.52	2070	8046
S. E. M	3.02	1 80	2.43	330	1001
Significance	No	No	Yes**	No	No
Critical difference	...	...	7.08	...	...
Conclusions	...	...	...	...	...
			G H F C A D B		

*** Only one replication was maintained due to want of sufficient material and hence only E.P.L.S. is studied.

APPENDIX LII

Spray Experiment to Compare the Efficacy of Proprietary Fungicides with that of Bordeaux Mixture.

Locality : O'&M' Block. C.R. Station Balehonnur. Started : May 1953.
Treatments: 4. Replications : 4. Layout : Randomized.
Comparative yields and Effective percentage of leaf survival.

	Treatments.	E. P. L. S. Feb. 56	E. P. L. S. Sep. 56	E. P. L. S. Feb. 57	Yld ripe cherry in lb. per acre. 1955-56	Yld ripe cherry in lb. per acre. 1956-57
A	Wetcol-15, 3 lb. in 40 gal. water	46.20	40.66	39.55	1638	3272
B	Fungi. Copper, Geigy 1 lb. „	51.90	46.24	50.90	2184	2924
C	Cupravit - 1 lb. „	48.35	42.40	48.95	1609	2497
D	Bordeaux mixture 2:2:40	49.70	49.14	47.60	1675	3881
	General mean.	49.04	44 61	46.75	1777	3142
	S. E. M.	1 63	1.76	2.69	217	379
	Significance.	No	Yes*	No	No	No
	Critical difference.	—	5.43	—	—	—
	Conclusions.	—	D B C A	—	—	—

APPENDIX LIII

Spray Experiment to Compare the Efficacy of Proprietary Fungicides with Bordeaux Mixture

Locality : Shegode Estate, Balehonnur. Started : September 1954.
Treatments: 6. Replications: 4 Layout : Randomized.
Comparative yields & effective percentage of leaf survival.

	Treatments	E. P. L. S. Feb. 56	E. P. L. S. Sept. 56	E. P. L. S. Feb. 57	Yield of ripe cherry in lb. per acre. 1955-56	Yield of ripe cherry in lb. per acre. 1956-57
A	Bordeaux 2 : 2 : 40.	35.90	65.15	48.10	2517.50	2453
B	Perenox - 1 lb. in 40 gal. water.	26.35	53.70	36.90	2011.50	2484
C	Blitox - „ „	43 15	67.60	47.60	1762 50	1752
D	Shell copper fungicide 1 lb. in 40 gal. water.	33.60	63.70	45 60	1846.25	2405
E	Parry's bye product 2½ : 2½ : 40	This treatment discontinued for want of material.				
F	Dithane Z-78-10 oz. in 40 gal water.	28.35	66.40	38.95	1033.50	1760
	General mean.	33 47	64 31	43.43	1834 25	2171
	S. E. M.	6 03	2.72	2.87	282	202
	Significance.	No	Yes**	Yes*	Yes*	Yes*
	Critical difference.	—	8.13	8.58	870	622
	Conclusions.	—	D C F A B	A C D F B	A B D C F	B A D F C

APPENDIX LIV

Spray Experiment to Compare the Efficacy of Blitox Ipsilion with Bordeaux mixture.

Locality : 'Crawford area' C.R. Station, Balehonnur. Started : June 1956

Treatments : 9. Replications : 5. Layout : Rondomized.

Comparative E. P. L. S. & mean percentage of diseased leaves.

	Treatments	E P. L. S Sept. 56	E P. L. S Feb. 57	Mean % age of diseased leaves Jul — Aug 57
A	Blitox Ipsilion 5 lb. in 300 gal. per acre	48.80	40.00	44.8
B	„ 10 lb. „	48.72	40.15	46·2
C	„ 15 lb. „	43 72	44.20	41·5
D	„ 5 lb. in 400 gal. per acre	45·44	36.85	46.3
E	„ 10 lb. „	50·58	40.50	38.8
F	„ 15 lb. „	46.40	41.70	42.3
G	Bordeaux mixtur 2 : 2 : 40, at 400 gal/acre	55·52	46.70	34·8
H	Control -- No spray.	40.20	34·00	64.9
*I	Bordeaux mixture 2 : 2 : 40, at 300 gal/acre	*–	49.20	40·0
	General mean.	46·42	41.48	
	S. E. M.	3 94	3·56	
	Significance.	No	No	

*This treatment was included only during the time of Sept. 56 spray application.

APPENDIX LV

Spray Experiment to Compare Mercurized Copperoxychloride with Bordeaux mixture.

Locality : 'L' Block, C.R. Station, Balehonnur. Started : Sept. 1954.

Treatments : 6. Replications : 4. Layout : Randomized.

	Treatments	E. P. L. S. Feb. 1956	Sept. 1956	Feb. 1957
A	Bordeaux 2 : 2 : 40	49.95	47.44	46.60
B	Mercurized copperoxychloride 2 lb. in 100 gall water	49.50	39.96	41.60
C	„ 3 lb „	45.45	42.84	41·95
D	„ 4 lb. „	40.95	40.24	36.45
E	„ 5 lb. „	42.70	45 52	26.25
F	Copper Sandoz 53 1 lb in 40 gall water	49.45	44.74	44 85
	General mean	46.33	43·45	39.62
	S. E M.	3·68	2 90	3.47
	Significance	No	No	Yes**
	Critical difference	—	—	10.24
	Conclusions	—		– A F C B D E

APPENDIX LVI

Spray Experiment to compare the Efficacy of Proprietary Fungicides with Bordeaux Mixture

Locality : L-1 Block, C R. Station, Balehonnur. Started : June 1956.

Treatments : 10. Replications : 5. Layout : Randomized.

Comparative E.P.L.S. and mean percentage of diseased leaves.

	TREATMENTS	E.P.L.S. Sept 1956	E.P.L.S. Feb. 1957	Mean % diseased leaves Jul.-Aug. 1957
A.	Cuprokylt 1 lb. in 40 gal water ...	45.90	42.05	45.4
B.	M C.M Copper-oxychloride do ...	42.18	47.75	59.8
C.	Colloidal Copper do ...	47.14	48.30	51.7
D	Captan—2 lb in 100 gal. water + 2 oz Ortho Sticker ...	41.46	49.60	52.5
E	do 4 lb do do ...	39.36	51.20	59.1
F	Ultra sulphur —1 lb. in 60 gal. water ...	34.40	37.85	64.8
G.	Bordeaux mixture 2: 2: 40- ...	56.16	45.55	36.2
H	do +Tenac sticker ...	57.08	49.75	44 0
I.	do +Ortho sticker 2 oz. in 100 gallons ...	56.88	56.25	43.9
J.	Control—No spray ...	35.00	35.75	69.4
	General Mean ...	45.55	46.40	
	S. E M. ...	2.74	2.64	
	Significance ...	Yes**	Yes**	
	Critical difference ...	7.56	7.32	

Conclusions.